EXCAVATING ENGINEER

1937 Highway Forecast

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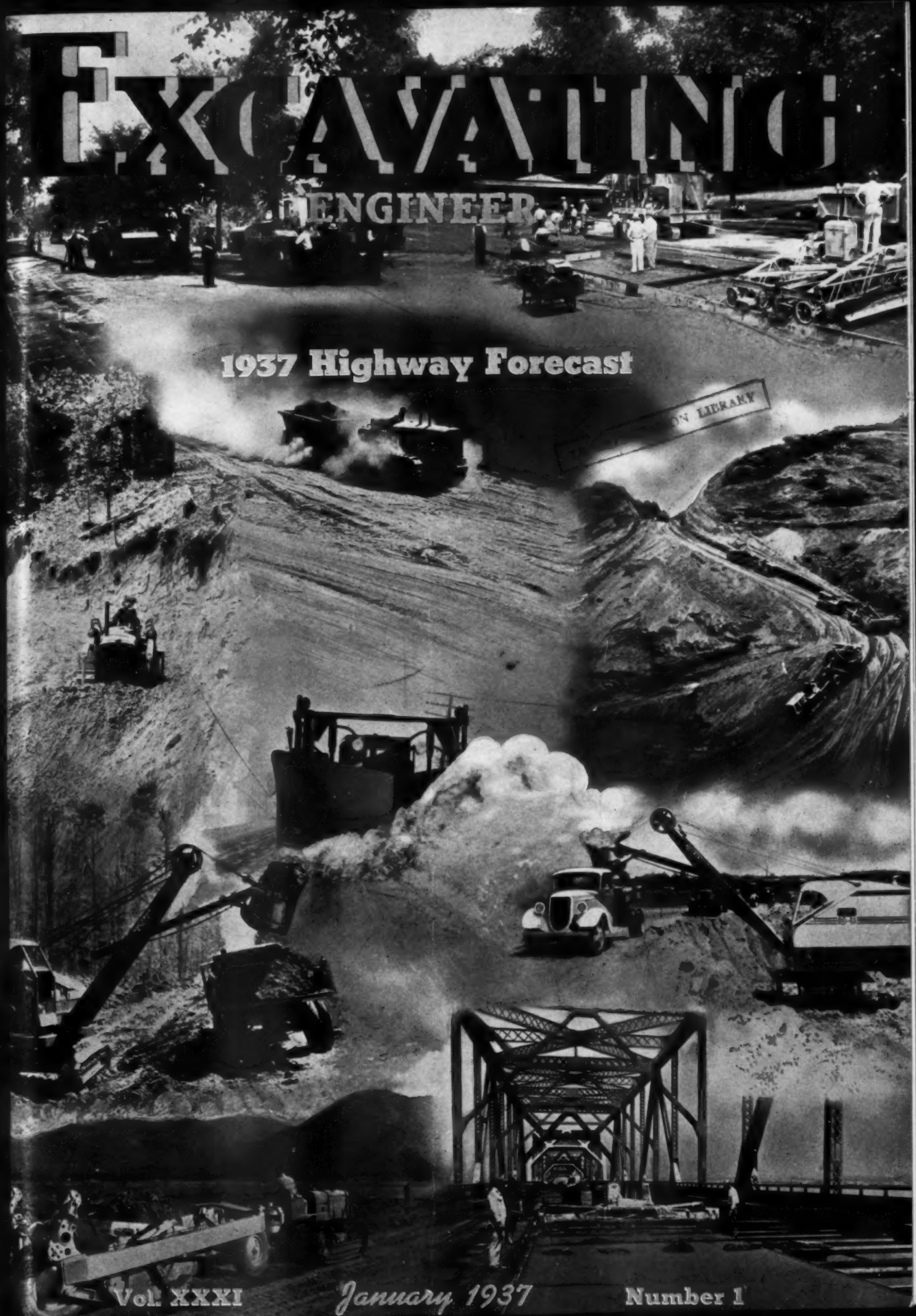

Vol. XXXI January 1937 Number 1

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TO EXCAVATION

About Excavating Projects — By Excavating Men — For Excavating Men — The World Over

Vol. 31 **JANUARY, 1937** **No. 1**

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We've Tried Everything

If you think William Williams solved all his difficulties in the last issue, wait until you read about his experiences in producing a movie epic!

Spillway at Fort Peck

The fourth article in our series of operating stories of this great earth fill dam. Disintegrating shale and cold winter weather are the hurdles successfully mounted in handling this 14,000,000-yard job.

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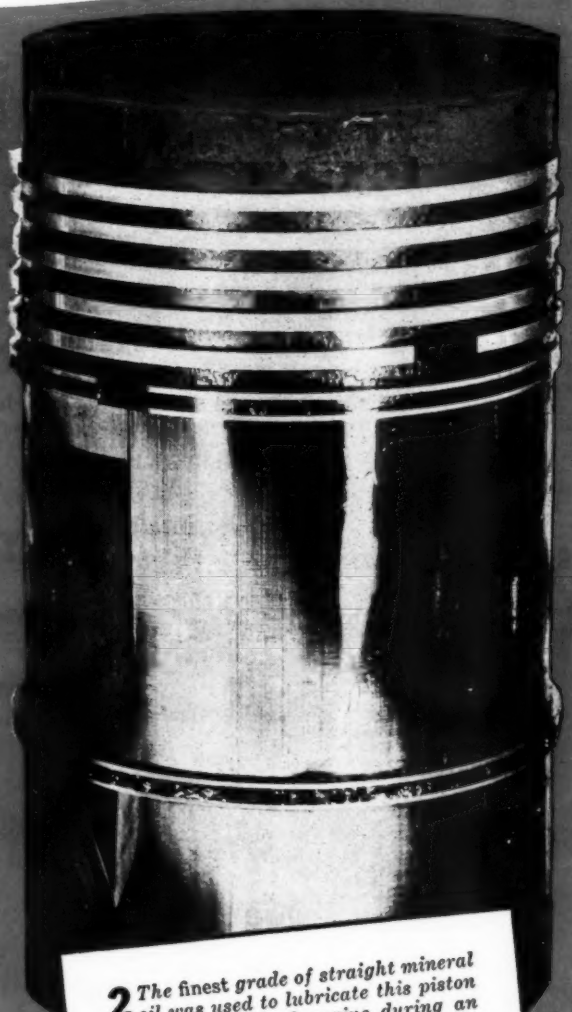
10 TIMES MORE Diesel

Sinclair Ten-ol is a special alloyed lubricating oil developed for "Caterpillar" Diesel engines by Sinclair Refining Company. During the past several months this new Diesel lubricant has been put through exacting research laboratory and field tests.

In full power comparative laboratory tests, "Caterpillar" Diesel engines lubricated with Sinclair Ten-ol gave ten times as many service hours without shutdown as the finest straight mineral oils. In the average of all tests, consumption of Ten-ol was approximately one-half that of high grade mineral oils. In one of the tests a Diesel lubricated with Sinclair Ten-ol operated at extremely high overload with no damage to the engine and all lubricated surfaces kept in perfect condition.

Below are authentic photographs of test pistons

1 *This piston was removed from a "Caterpillar" Diesel engine after an accelerated laboratory operation test. A poor grade of straight mineral oil was used throughout the test. Note the badly stuck rings which caused loss of compression, blow-by and excessive ring wear. Serious oil pumping was also caused by badly plugged oil control rings.*

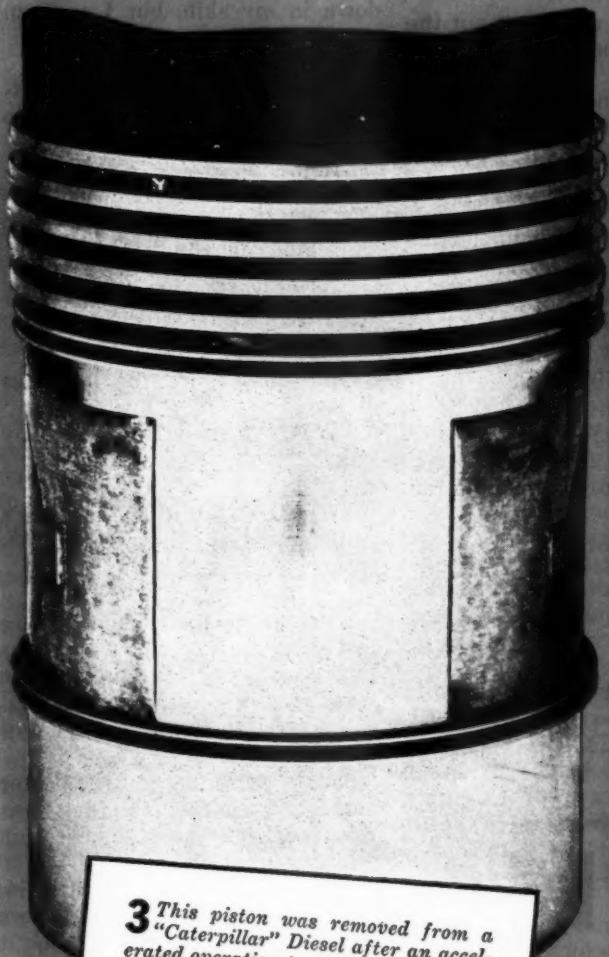


2 *The finest grade of straight mineral oil was used to lubricate this piston in the same Diesel engine during an accelerated operation test of the same duration as No. 1. Poor piston seal is indicated by signs of excessive blow-by. Note the carbon-coated piston crown, sludge, plugged oil control rings and gum on piston skirt. Wear on liners is still excessive.*

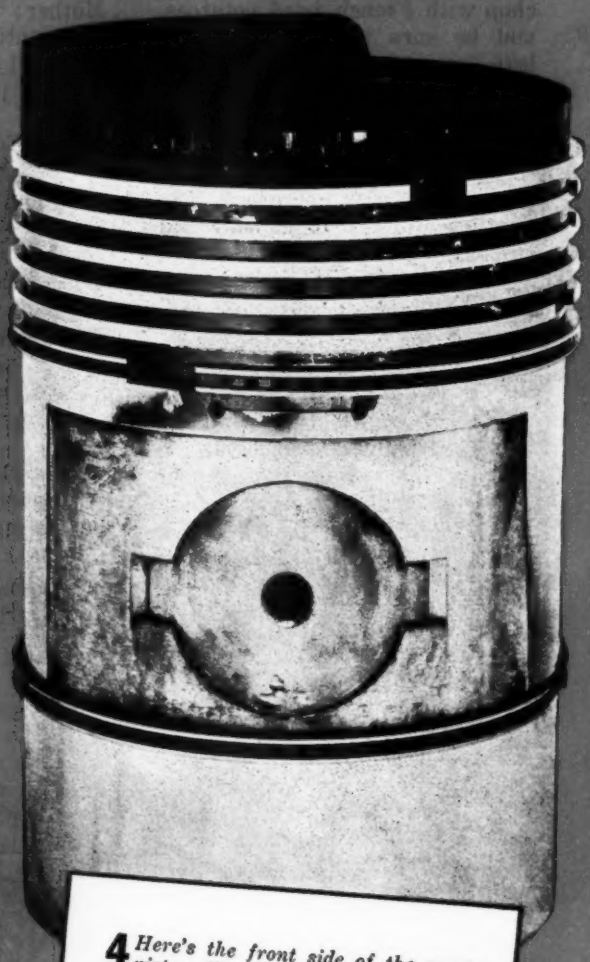
el service hours with SINCLAIR TEN OL

taken after exacting laboratory tests. The piston photos have *not been retouched.* Read the captions under each photo—they tell the remarkable story of Sinclair Ten-ol's outstanding superiority. It will mean a tremendous saving in your own Diesel operation.

Sold by your local Sinclair representative.



3 *This piston was removed from a "Caterpillar" Diesel after an accelerated operation test* ten times as long *as that of No. 1 and No. 2 on the left. Sinclair Ten-ol lubricated the Diesel throughout the test. Note the absence of ring-sticking, the perfect condition of oil-control rings, freedom from blow-by and absence of gum on piston skirt. Ring and liner wear are negligible.*



4 *Here's the front side of the same piston (No. 3) after the test with Sinclair Ten-ol. Note that all piston rings are clean and move freely. Experts pronounce this the cleanest, most perfect Diesel lubrication job ever obtained.* Sinclair Ten-ol multiplies Diesel service hours by ten!

Sinclair Ten-ol is recommended as a "New Outstanding Diesel Engine Lubricant" by the Caterpillar Tractor Co. Order Sinclair Ten-ol, Sinclair Diesel fuel and other Sinclair products from your local Sinclair office or write Sinclair Refining Company, 630 Fifth Avenue, New York City.

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Not in the Contract

Observing a young lady standing alone, the young man stepped up to her and said:

"Pardon me, you look like Helen Black."

"Yes," she replied, "I know I do, but I'd look even worse in white."

"Waiter, I'll have one big pork chop with French fried potatoes, and be sure to have the chop lean."

"Yes, madam, which way?"

A fat lady stepped on the scales, not knowing it was out of order, and put in her penny. The needle went up to 75 pounds—and stopped.

An inebriated gentleman who was watching intently, staggered.

"My God!" he said. "She's hollow."

Tourist—"This seems to be a very dangerous precipice. It's a wonder they don't put up a warning sign."

Native—"Yes, it is dangerous, but they kept a warning sign up for two years and no one fell over, so it was taken down."

"She'll come along soon, without a doubt."

"Yeah? She'll come doubtin' my sobriety, my veracity and my fidelity."

Coed (just home for a vacation): "Mother, an old farmer came out to the lake where I was swimming in the nude."

Mother: "I suppose you had to stay in until he left?"

Coed: "I did not. I got out the minute he jumped in."

"Was Ed shocked over the death of his wealthy aunt?"

"Shocked? He was electrocuted."

"Why didn't you shave this morning?"

"I thought I did but there were twelve of us using the same mirror this morning and I must have shaved some other guy."

"Come along with Bill and me on our yacht?"

"Say, what do you take me for, a sap?"

"Of course not, Bill's bringing his own girl."

"Your dress is too short."

"I don't think so."

"Then you must be in it too far."

"These pants are too tight," said the small boy. "They're tighter than my skin."

"Come now, Willie," said his mother. "You know that's not true."

"Well," said Willie, "I can sit down in my skin, but I can't in these pants."

"Poor Bud! He's so short-sighted he's workin' himself to death."

"How come?"

"Well, he can't see when the boss is looking, so he has to keep shovelling all the time."

"How did you like that last kiss?"

"Not much."

"But kisses are the language of love."

"Well, then quit your baby talk."

The slogan for a nice evening's entertainment: So-fa and no-father.

During the hydrophobia scare last summer, a friend of ours was bitten by a dog. Biter and bitee were promptly rushed to a hospital, where test's were taken of the dog's blood.

"Now, don't worry," the doctor said. "If we find the dog was mad, we'll give you some serum and fix you up all right."

When the test results came in, the doctor became even more soothing. "Well, well" he said, "it was mad. No danger, though, this stuff will make you O.K."

Our friend grabbed pen and paper, without answering, and began to write.

"Here," said the doctor sharply, "there's no reason to make your will."

"Will, hell!" was the retort. "I'm making a list of the people I want to bite."

"He said he was sorry some dirt got on ya, lady—now won't you please let go of the dipper?"

1937 Highway Forecast

Coming year offers possibility of even bigger year than 1936 . . . Highways to be important subject at sessions of 43 state legislatures . . . Federal funds assured through 1939 . . . Continued growth of public concern with highway safety . . . 40 states make thorough road surveys . . . Anti-diversion efforts increase.

HIGHWAY construction can amount to over $800,000,000 in 1937, if states all match available federal funds, according to T. H. MacDonald, Chief, Bureau of Public Roads. Whether or not the states take full advantage of their highway opportunities, a substantial program is assured.

With 43 state legislatures having regular sessions in 1937, and with new relief appropriations coming up before Congress, highways are bound to come in for considerable government attention. If united and strenuous effort is made to halt diversion, this year's construction funds should easily surpass the $600,000,000 1936 total, which is the highest figure since 1931. It should be noted that these figures refer to federal and state funds. With better general conditions, county and township road expenditures should show notable increase this year. It is estimated that over 28,000,000 cars will be in use in 1937—which means considerably increased receipts from gasoline and vehicle taxes.

Four significant factors, originated in 1936 or earlier, will have an important bearing on the 1937 and subsequent highway situation.

First, while the recent Hayden-Cartwright Act assures a definite federal aid program through the fiscal year of 1939, the amount of federal participation is almost certain to decrease from the emergency levels. Thus, it is particularly important to get highway financing on a normal and, as nearly as possible, self-supporting basis. It has become increasingly evident that we can never reach the highway saturation point; that we must continually be building new highways and adapting the existing system to new demands. It is vital, therefore, to set up a definite undivertable source of income to handle the essential program.

In 1936, 40 states began statewide surveys of traffic conditions, with the authorization and cooperation of the Bureau of Public Roads. This step is of tremendous significance as it marks the recognition of the need for a soundly based, long-time plan for an interrelated, nation-wide highway system. This survey will show just what development is necessary for adequate accommodation of modern traffic. It will provide a scientific basis for planning new highways and rehabilitating the existing systems, and will also afford a foundation for equitable and adequate taxation plans to pay for the requisite work.

It would be the part of wisdom for state legislatures to await the results of these surveys before making permanent commitments on tax rates and uses.

The third significant factor, not new in 1936, but of constant, growing importance, is the fight against diversion. Motorists have cheerfully paid high vehicle and gasoline taxes on the assumption that the proceeds were to be used in building up and maintaining the highways. Any other use of revenues based on the distance travelled by an individual is manifestly unfair and dangerously unwise. Unfortunately, these taxes are easily collected, and the total revenue is so large that many legislatures, pressed for funds in the past lean years, have been unable to resist dipping into them for general purposes to an ever increasing extent.

The $147,000,000 diverted in 1935 would have been sufficient to build a high type highway from New York to San Francisco, another from Chicago to New Orleans, and a third from New York to Jacksonville, Florida. And it is estimated that an even larger sum was diverted in 1936.

The only way in which diversion can be halted is for those interested in highways to keep the true facts continually before

• *With the pick-up of conditions in the crushed stone industry in 1936, equipment in many quarries was modernized to enable output to keep pace with demand. Here are two new electric loading shovels and an all-steel blast-hole drill in a New York quarry.*

the public. Millions of people are willing to vote against diversion, but someone must assume and maintain vigilant leadership in the fight. Who better than those whose business is the building of modern roads?

Colorado, Minnesota, Missouri, and Kansas have constitutional prohibition of diversion, and Maine has passed a law with similar effect. A petition against diversion, bearing over 50,000 signatures, has been filed with the secretary of state in Massachusetts. South Dakota is seeking a constitutional amendment forbidding diversion. In Rhode Island, Pennsylvania, and Virginia strenuous efforts are being made to render diversion illegal.

A continuous, militant warfare against diversion should bring even better results in 1937 because of the rapid increase in other tax revenues and a material reduction in relief requirements.

Concern with highway safety continued to be an important factor in 1936, and is likely to be even more influential in 1937. Widespread articles in magazines and newspapers have stirred the public to a realization that our highway development has not kept pace with the development of our modern motor cars. Experiments have shown how road hazards can be tremendously reduced by modern construction. Experimental lighting installations point the way to increasing safety in night driving. Safe roads today are expensive, but the public is paying for them and is beginning to demand them.

It is certain that 1937 holds great possibilities for highways and those interested in them. The year can mean another big step away from the hit-and-miss systems of the past and toward a sound, far-sighted future. The extent to which the possibilities become actualities depends on the unity and steadfastness with which all concerned work for the common cause.

No increase in gasoline sales tax rates or in motor registration fees is necessary in any state to obtain funds to match federal highway allocations, according to studies of the American Petroleum Industries Committee. Fear has been expressed in several states that increased taxation of gasoline and automobiles might be necessary to obtain federal highway aid.

Unless a state diverts part of its automotive taxes to other highway uses, and by reason of such diversion lacks funds to match federal aid, the state is eligible to receive its full allocation, it was explained. The Hayden-Cartwright Act provides that: "If the proceeds of all special taxes on motor-vehicle transportation are applied to highway purposes, all, or such portion, of each apportionment as the state is unable to match shall be available for expenditure in such state in accordance with said Federal Highway Act without being matched by the state with state funds."

If a state is now diverting highway revenues to other purposes, receipt of the full amount of federal road aid funds can be assured by stopping such diversion at the earliest practicable date rather than by enacting new and increased revenue measures. Of $828,424,000 in gasoline and automotive taxes collected by the states last year, $146,449,711 was diverted to purposes other than highway financing.

Forecasts by States

Alabama

If state revenue is not obtained to match the total Federal Aid allotted to Alabama, the highway construction program will be one of the smallest in the history of the state. At present only $836,064 of the regular Federal Aid of $4,372,223 can be matched by the state.

Revenues other than Federal Aid are as follows: balance, October 1, 1936, $71,446; gasoline excise tax, $6,000,000; motor vehicle license, $2,500,000; motor carrier fees, $150,000; miscellaneous, $350,000.

Disbursements are planned as follows: Lease, Alabama Bridge Corp., $275,000; interest and sinking fund—first issue bonds, $1,234,780; interest and sinking fund—second issue bonds, $1,490,555; administration, $300,000; construction, $2,200,000; maintenance, $2,000,000; Federal aid program submitted, $836,064; contingencies, $300,000. This anticipated program leaves an unobligated balance of $435,047.

During the past year 691 miles of paved highways were added bringing the total miles paved on the Alabama system to 2,668 miles. The state system is now 41 per cent paved. Expenditures for that same period amounted to $14,969,117.

Arizona

Because Arizona highway expenditures are based on a fiscal year from July 1 to June 30, figures for 1937 are tentative. A conservative estimate, however, sets the total highway expenditure for the year at $6,890,800. This is a decrease of about $2,000,000 from 1936 funds.

Sources of income will be as follows: Hayden-Cartwright Act, $1,785,000; other Federal funds, $500,000; state gas tax, $2,900,000; vehicle license fees and other sources, $1,400,000. Construction will consume $5,500,000 and maintenance, $1,390,800. The construction program is not outlined at present.

No highway funds were diverted in Arizona in 1936 and $750,000 in previously awarded contracts will be carried over into 1937.

Arkansas

Funds for construction purposes during the 1937 calendar year are limited to $900,000, the amount of Federal apportionment for grade crossing protection and elimination, and available after July 1, 1937, according to W. W. Zass, Chief Engineer. This sum does not have to be matched by the state.

Normal Federal Aid funds to the approximate amount of $2,125,000 are anticipated as being available after July 1, 1937, for the 1938 fiscal year. It is expected that this amount will be matched and utilized.

At the present time the entire revenue received from automobile registration fees and the gasoline tax is obligated for maintenance and debt service, leaving no funds available for construction work.

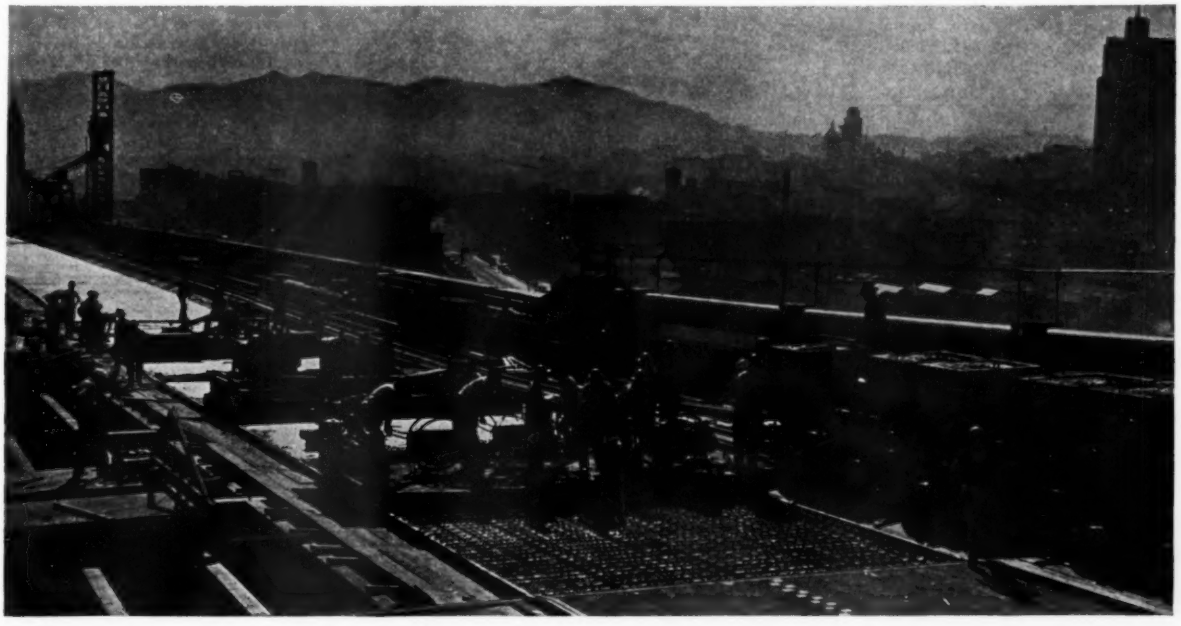
California

California's highway program is established on the basis of a biennial budget which is subject to the approval of the governor and adoption by the state legislature. The biennium covered by the next budget, now in the preparatory stage, prior to its submission to the governor by the California Highway Commission at the time the state legislature convenes in January, will include the period from July 1, 1937, to June 30, 1939.

The state highway budget will be based upon an anticipated revenue for highway purposes for the biennium of approximately $73,700,000. This biennial revenue is expected to be derived from $58,000,000 gasoline tax; $6,200,000 motor vehicle license fees; and $9,500,000 regular Federal Aid, authorized under the Hayden-Cartwright Act.

From the total of $73,700,000 as the state's share of revenue, an amount of approximately $14,500,000 must be deducted for statutory allocations for expenditure within the corporate limits of cities. These city funds must be expended one-half on state highway routes within the cities, and one-half on streets of major importance other than state highway routes.

Details of the budget cannot be furnished at this time, but the funds will be divided approximately in the following amounts: maintenance, $16,500,000; administration, $2,600,000; major construction projects, $28,100,000; and the balance, $26,500,000, will be used to finance right of way costs, betterments, minor improvements, allocations to



• *Bates & Rogers forces shown completing final section of pavement between San Francisco and Oakland on Oakland Bay Bridge, using a Jaeger Type "D" Finisher.*

• Macco Construction Company used a fleet of Caterpillar Diesel tractors pulling two LeTourneau 12-yard carryall scrapers in tandem, on construction of this approach to San Francisco's Golden Gate Bridge.

joint highway districts, engineering charges, and contingencies.

In addition to the revenue listed above, it is estimated that for the biennium, California will be apportioned about $3,700,000 from the funds appropriated by Congress for grade crossing elimination and about $1,900,000 from the Federal appropriation for improvement to feeder and secondary roads. No budget, however, will be prepared for these funds until Federal rules and regulations governing their expenditure has been received from Federal authorities.

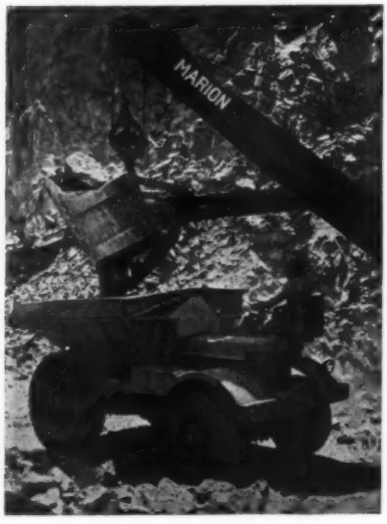
Work on the California State Highway System authorized under the budget for the current biennium, including WPA funds, has largely been completed or is now under way, and only a few projects remain to be placed under contract.

Colorado

The main source of funds for 1936-37 in Colorado is from the sale of $25,000,000 in anticipation warrants guaranteed by proceeds from motor vehicle fees and motor fuel taxes, according to a wire received from O. T. Reedy, Senior Assistant Highway Engineer.

Approximate 1936 expenditures were, anticipation warrants projects, $6,340,000; and Federal Aid projects, $6,730,000. Division of funds was as follows: general projects, $2,000,000; oiling, $1,500,000; maintenance, $1,600,000; highway patrol, $250,000; administration, $300,000; and miscellaneous, $260,000. Federal grants were as follows: Works Progress highway program, $3,400,000; grade crossing program, $2,600,000; Federal Lands, $190,000; and flood relief, $1,000,000.

Anticipated 1937 expenditures will be Federal Aid, $5,500,000; grade separation, $950,000; and anticipation warrants, $12,700,000. The program planned to date calls for the following division of work: general state projects, $1,200,000; oiling, $1,500,000; maintenance, $1,600,000; highway patrol, $250,000; and administration, $300,000.



• Driscol Construction Co. handled this road job in the Royal Gorge, near Cotopaxie, Colorado, with a Marion shovel loading Koehring Dumptors.

Connecticut

An increase of 8 per cent over 1936 is expected in funds available for 1937 highway work, according to the State Highway Department. A total of $22,000,000 is anticipated. Federal funds will be the source of $3,400,000, with the Hayden-Cartwright Act providing $130,000. State gas tax receipts are estimated at $8,200,000; vehicle license fees, $5,000,000. In addition, probable receipts from bonds issued by Fairfield and Middlesex counties for the Merritt Highway and the Middletown-Portland Bridge, are $5,570,000.

Of total funds available, $13,350,000 will be used for construction, $4,800,000 for maintenance, and $3,850,000 for other purposes.

Delaware

Estimated expenditures for 1937 highway work in Delaware compare favorably with the amount expended in 1933, according to Samuel Knopf, Principal Assistant Engineer.

The funds are provided by Federal Aid, $609,375; state gas tax, $1,800,000; vehicle license fees and other sources, $975,000; and police fines, $60,000.

The construction program is as follows: 10 miles of gravel or crushed stone costing $600,000 and requiring 65,000 tons of material; 200 miles of oil treatment at $150,000 with 1,100,000 gallons of oil and 36,000 tons of chips; 20 miles of high-type paving at a cost of $600,000; 10 miles of low type paving at a cost of $100,000 requiring 35,000 tons of stone; and 3 bridges totalling $125,000.

The excavation of 30,000 yards of material at a cost of $25,000 will be carried over from 1936. A diversion of $85,000 is reported for last year.

Florida

Highway work in Florida will be decreased by about 23 per cent in 1937, according to preliminary information received from W. M. Boozer, Division Engineer of Plans and Surveys. An estimated total of $12,150,545 will be spent.

The funds will be made up as follows: Federal Aid, $2,567,698; WPA funds, $582,847; and state gas tax, $7,500,000. Details as to the division of 1937 con-

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Motor vehicle users paid special State taxes amounting to $950,971,000 in 1935 according to reports of State officials to the Bureau of Public Roads of the U. S. Department of Agriculture. Of this amount $761,533,000 was allocated for highway purposes and constituted by far the largest source of highway revenue. State highways received $522,130,000, local roads and streets were allotted $238,134,000 and $1,269,000 went for miscellaneous highway purposes. Collection and administration costs amounted to $31,761,000. The taxes reported are: On motor vehicle registration $318,748,000; State taxes on gasoline $619,802,000; and State motor-carrier taxes $12,421,000. Other taxes paid on motor vehicles and garages as property and on the businesses of motor carriers are not included.

A total of $147,142,000 was diverted to non-highway purposes, $86,658,000 going to general funds, $16,925,000 for relief, $30,773,000 for education and the remainder was allocated for miscellaneous purposes. Approximately $10,000,000 of the total collections was undistributed at the end of the year.

● *In Evanston, Illinois, this street is being finished by three Adnun Black Top Pavers, powered by Hercules engines.*

struction funds are not yet available.

In 1936 no highway funds were diverted in Florida.

Georgia

Details of the 1937 highway program for Georgia have not yet been worked out. Information from the State Highway Board indicates that approximately $29,300,000 will be available—an increase of $4,000,000 over 1936.

Funds will be available from the following sources: Hayden-Cartwright Act, $18,000,000; State gas tax, $10,000,000; vehicle license fees and miscellaneous, $1,300,000.

About $22,000,000 will be used for construction, $2,000,000 for maintenance, $2,800,000 for other purposes, and $2,500,000 will go to the counties. No data is now ready on the type of work to be undertaken.

Idaho

An estimated decrease of 29 per cent in highway funds is reported for the State of Idaho by G. E. McKelvey, Commissioner of Public Works. This will allow $2,155,000 for construction; $1,500,000 for maintenance; and $838,000 for other work, a total of $6,493,000.

Of this amount, $2,763,000 is in Federal funds as follows: Federal Aid, $2,163,000 Federal lands, $185,000; grade separation, $415,000. The remainder of $3,730,000 is provided for by state funds to the amount of $3,500,000 from the gas tax and $230,000 from motor vehicle fees.

A division of 1937 highway funds into types, miles, amounts and quantities is not available at this early date.

The excavation of 332,000 yards previously awarded, at a cost of $105,000 is to be carried over into 1937, and no highway funds were diverted in Idaho in 1936.

It has been estimated by the American Petroleum Institute Committee that nearly 170,000 jobs would be created if taxes collected from motorists were used entirely for highway construction and maintenance, and if those states having excessively high rates of gasoline taxes lowered them.

The $146,449,711 diverted in 1935 would have provided 150,500 jobs—55,600 in direct road work, and 94,900 in 24 industries supplying highway equipment and materials. Reduction in gas tax rates in 18 states where the tax exceeded 4 cents would have resulted in 20,000 additional jobs.

A recent study of the U. S. Bureau of Public Roads indicate that $1.00 spent on road work results in the distribution of $3.15 in wages and trade in 24 industries. On that basis the diversion of road funds in 1935 reduced wages and trade by $462,000,000. More than 25,000 miles of farm-to-market roads could have been improved with the money abstracted from the highway funds.

Illinois

A total of about $35,000,000 will be spent for highway work in Illinois in 1937. This sum includes $16,000,000 in previously awarded contracts carried over from 1936. Although this budget represents a 15 per cent increase over last year, actual expenditures will be about the same because there is likely to be a carry-over at the end of 1937.

Construction will be financed as follows: PWA funds, $900,000; 1936 and 1937 regular Federal Aid funds, $6,400,000; U. S. Work funds, $8,300,000; 1938 Federal Aid, $5,000,000; 1938 secondary road funds, $1,000,000; 1938

● *Melahn Construction Company are using their new International Harvester TracTracTor, equipped with Bucyrus-Erie Bulldozer, in leveling this road fill near Woodstock, Illinois.*

United States Public Works Road Construction—N. I. R. A.

As of October 31, 1936

STATE	APPORTIONMENTS		COMPLETED				UNDER CONSTRUCTION				APPROVED FOR CONSTRUCTION			BALANCE OF FUNDS AVAILABLE FOR NEW PROJECTS	
	Sec. 204 of the Act of June 16, 1933 (1934 Fund)	Act of June 18, 1934 (1935 Fund)	Total Cost	1934 Public Works Funds	1935 Public Works Funds	Mileage	Estimated Total Cost	1934 Public Works Funds	1935 Public Works Funds	Mileage	1934 Public Works Funds	1935 Public Works Funds	Mileage	1934 Public Works Funds	1935 Public Works Funds
	$	$	$	$	$		$	$	$		$	$		$	$
Alabama	8,370,133	4,259,842	15,305,076	8,304,382	3,512,878	759.3	467,758	52,665	415,093	16.7		304,982	2.5	13,085	26,890
Arizona	5,211,960	2,641,935	8,980,818	5,204,513	2,570,184	543.0	12,500		12,500					7,447	59,250
Arkansas	6,748,335	3,428,049	10,906,509	6,634,351	3,303,237	618.5	128,046	39,554	88,261	3.7	26,258	18,148	1.0	48,172	18,403
California	15,607,394	7,932,206	30,587,308	15,586,149	7,774,590	758.8	115,026		115,016			820		21,805	41,781
Colorado	6,874,550	3,486,006	11,255,101	6,871,970	3,441,857	639.7						6,619	1.3	2,560	37,530
Connecticut	2,865,740	1,454,868	4,514,547	2,758,269	1,312,944	74.0	36,318	36,318			22,245			48,505	141,924
Delaware	1,819,088	923,395	2,680,794	1,818,804	815,188	128.3	109,467		105,525	1.6				284	2,682
Florida	5,231,834	2,661,343	8,697,748	5,175,534	2,344,564	305.6	254,979		230,665	4.0	56,300	67,339	.5		18,775
Georgia	10,091,185	5,113,491	12,946,454	9,323,487	2,901,876	734.0	1,356,136	403,675	934,433	91.7	84,072	166,158	3.6	279,952	1,111,025
Idaho	4,486,249	2,277,486	6,927,035	4,416,568	2,088,070	501.1	157,793		155,185	.4	42,905	1,521		26,776	32,710
Illinois	17,570,770	8,921,401	25,063,825	16,835,536	7,260,243	695.1	2,446,315	635,560	1,627,395	21.9	60,380	7,424	20.0	39,294	26,339
Indiana	10,037,843	5,088,963	15,312,360	9,866,563	4,723,209	476.6	364,807	158,675	205,932	11.5		108,068		12,405	51,754
Iowa	10,055,660	5,118,361	15,428,981	10,055,161	4,777,361	1,221.9	361,891		341,000	5.4	499				
Kansas	10,089,604	5,117,675	15,350,281	10,003,733	5,012,125	1,131.1	228,634	79,764	61,887	14.4				6,107	43,663
Kentucky	7,517,359	3,818,311	11,944,166	7,448,139	3,554,163	807.7	218,152	59,003	159,149	5.2		72,331	2.8	10,217	32,669
Louisiana	5,828,591	2,963,932	8,983,157	5,731,324	2,593,089	252.5	318,465	56,549	198,434	13.4		128,372	5.2	40,718	44,037
Maine	3,369,917	1,711,586	5,239,639	3,346,881	1,657,506	193.1	7,234		7,234		16,120	11,600	.9	6,916	35,046
Maryland	3,564,527	1,810,058	5,364,565	3,345,772	982,038	143.7	270,868	131,266	127,806	9.8		347,837	7.6	87,489	352,376
Massachusetts	6,597,100	3,350,474	9,852,801	6,552,733	2,647,991	115.2	431,715		431,715	.3		91,944	.1	44,367	178,824
Michigan	12,736,227	6,452,568	20,358,539	12,696,114	6,060,606	754.9	413,100	40,113	252,523	13.2		136,788	.4		2,651
Minnesota	10,656,569	5,425,551	16,086,304	10,520,596	4,749,113	1,632.0	494,238	58,110	390,348	17.2		34,800	.6	77,863	251,290
Mississippi	6,978,675	3,540,227	12,548,013	6,723,551	2,863,665	715.1	787,650	188,861	598,789	28.8	3,960	41,111	1.9	62,304	36,662
Missouri	12,180,306	6,173,740	17,409,640	11,637,146	4,718,947	1,436.5	2,114,082	471,210	1,380,892	15.3		62,100		71,949	11,801
Montana	7,439,748	3,769,734	11,707,589	7,423,766	3,610,494	1,048.2	147,241		147,241	10.2				15,982	11,999
Nebraska	7,828,961	3,964,364	12,833,314	7,813,593	3,613,693	1,018.3	283,045		270,939	27.6		63,537	5.9	15,368	15,995
Nevada	4,545,917	2,302,356	7,078,791	4,545,917	2,266,933	764.5	26,804		26,804			1,650			6,969
New Hampshire	1,909,839	969,462	2,981,515	1,904,951	933,904	77.7	4,174		4,174			16,591	.6	4,888	14,793
New Jersey	6,346,039	3,220,879	8,075,122	6,050,468	1,519,036	82.0	2,148,474	120,518	1,499,346	14.2	82,145		.6	92,907	202,497
New Mexico	5,792,935	2,941,700	8,816,508	5,776,859	2,819,242	743.9	32,518		20,225	1.5				16,076	102,233
New York	22,330,101	11,327,921	38,706,319	21,769,967	10,046,563	815.2	1,815,030	414,610	1,031,899	8.6	111,647	162,275	1.3	33,877	87,783
North Carolina	9,522,293	4,840,941	14,668,317	9,048,673	4,394,008	1,329.6	540,290	402,234	138,056	27.7	51,017	253,514	8.2	20,369	55,363
North Dakota	5,804,448	2,938,967	8,288,425	5,589,998	1,968,494	2,092.9	570,401	139,342	409,600	50.7	15,703	219,659	27.9	59,405	341,214
Ohio	15,484,592	7,865,012	23,905,703	15,324,142	6,775,436	774.3	1,121,223	104,228	969,176	21.9	34,023	81,694	4.3	22,200	38,706
Oklahoma	9,216,798	4,685,180	14,528,221	9,146,846	4,303,265	804.9	182,756	67,007	115,745	1.6		174,301	.2	2,945	91,868
Oregon	6,106,896	3,097,814	9,772,555	5,985,422	2,932,035	465.4	221,747	64,950	89,384	3.3		85,041		56,524	51,354
Pennsylvania	18,891,004	9,590,788	28,274,723	18,174,426	8,714,537	1,023.8	927,289	418,858	411,006	38.2	153,388	163,753	4.3	144,332	301,693
Rhode Island	1,998,708	1,014,572	3,144,602	1,998,708	1,012,547	89.1									2,026
South Carolina	5,459,165	2,770,954	7,832,225	5,232,144	2,319,317	612.3	421,097	171,812	237,426	14.6	46,320	119,798	2.1	8,888	94,414
South Dakota	6,011,479	3,047,643	9,187,205	5,811,337	2,800,111	1,536.9	284,062	110,078	173,984	44.5		11,078	8.8	90,064	62,470
Tennessee	8,492,619	4,302,991	13,369,285	8,492,543	3,839,608	490.9	369,442		369,442	5.4		43,164	5.9	76	50,776
Texas	24,244,084	12,291,253	37,518,234	23,907,965	11,731,914	2,772.8	543,093	284,494	223,387	7.2		13,038	7.3	51,565	322,913
Utah	4,194,708	2,132,691	7,338,246	4,160,916	2,094,401	590.9	70,718	32,291	38,290					1,500	
Vermont	1,867,573	948,007	3,144,785	1,863,531	984,950	140.3	21,644	3,922	17,722	.7				121	5,335
Virginia	7,416,757	3,765,387	11,586,281	7,294,304	3,345,109	601.4	189,561	8,575	180,986	22.4	79,615	157,214	25.6	34,264	82,078
Washington	6,115,867	3,106,412	9,369,715	6,100,928	3,022,752	302.7	46,596		46,596		11,114	14,748	.3	3,825	22,315
West Virginia	4,474,234	2,280,335	6,115,399	4,315,121	1,514,235	209.9	735,027	83,534	594,986	12.5		66,425	.7	75,579	104,689
Wisconsin	9,784,881	4,941,837	15,415,670	9,716,001	4,875,594	619.7	24,316		24,316			7,915		8,880	34,012
Wyoming	4,501,327	2,287,712	6,879,280	4,451,922	2,218,377	1,037.7	5,781	5,780		.3		33,085		43,624	36,250
District of Columbia	1,918,469	973,642	2,678,699	1,909,584	968,979	22.3	8,885	8,885							4,863
Hawaii	1,871,062	949,778	2,693,451	1,870,383	264,953	51.1	650,838		646,859	4.8		14,000		679	23,966
TOTALS	394,000,000	200,000,000	618,053,780	386,537,691	176,496,131	34,758.4	22,487,226	4,852,641	15,526,771	588.6	897,711	3,250,642	152.4	1,711,957	4,726,456

• *Keeping rural roads in shape is a big job for county highway forces. Plymouth County, Iowa, is working on this road near Merril with a Cletrac tractor and Austin-Western hand-operated grader.*

grade crossing funds, $2,500,000; and the balance in state funds, $10,900,000.

The program will include 250 miles of pavement; 25 miles of bituminous surfacing on existing gravel or crushed stone; 345 miles of gravel or crushed stone surfacing; 295 miles of grading; 100 bridges; and 48 railroad grade separations.

Indiana

Indiana anticipates an expenditure of $11,400,000 for highway work in 1937, according to information received from the State Highway Commission. This is a 37 per cent decrease from 1936 funds.

Income will be obtained from the following sources: Hayden-Cartwright Act, $3,000,000; state gas tax, $5,990,000; vehicle license fees and other sources, $2,410,000. Preliminary plans indicate that $8,000,000 will be spent for construction and $3,400,000 for maintenance.

Construction plans are not definite as only the sum of $945,864 for grading is available at present. When the total sum is available construction funds will be allocated as follows: grading, $945,864; roadside improvement, $79,173; high type paving, $5,419,229; low type paving, $174,677; and $1,381,057 for bridges.

Data on the yardage and cost of previously awarded excavation contracts to be carried over are not available. About $1,500,000 in highway funds was diverted in Indiana in 1936.

Iowa

An increase of 29 per cent in available funds will allow an expanded highway program in Iowa in 1937. A total of $37,400,000 will be spent, with $14,400,000 accessible from the Hayden-Cartwright Act; $6,650,000 from the state gas tax; and $16,350,000 from vehicle license fees and other.

The Public Works Administration had allotted money for 896 non-federal projects, as of October 31. PWA grants totalled $71,835,370, the loans, $27,290,625. Total estimated construction costs were $293,863,608. A non-federal program is so designated because the applicant furnishes the larger portion of the costs.

The Public Works Administration also allocated $400,000,000 to the Bureau of Public Roads for expenditure in conjunction with the State Highway Departments. This came from the funds made available by the NIRA.

Construction work will total $21,150,000; maintenance, $3,900,000; and other, $12,350,000.

Complete details of the program are not ready at this time, but preliminary plans show that construction will be divided into the following mileage: grading, 250 miles; gravel or crushed stone, 250 miles; oil treatment, 120 miles; and high type paving, 300 miles.

Kansas

Because the Kansas highway program for 1937 is only partially completed, the figures given out by H. D. Barnes, State Highway Engineer, are only approximate and should be regarded as estimates.

The total amount available for highway work is estimated at $14,700,000, with $10,000,000 for construction, $3,400,000 for maintenance, and $1,300,000 for resurfacing. This represents a decrease of 36 per cent from the expenditures for these same items in 1936.

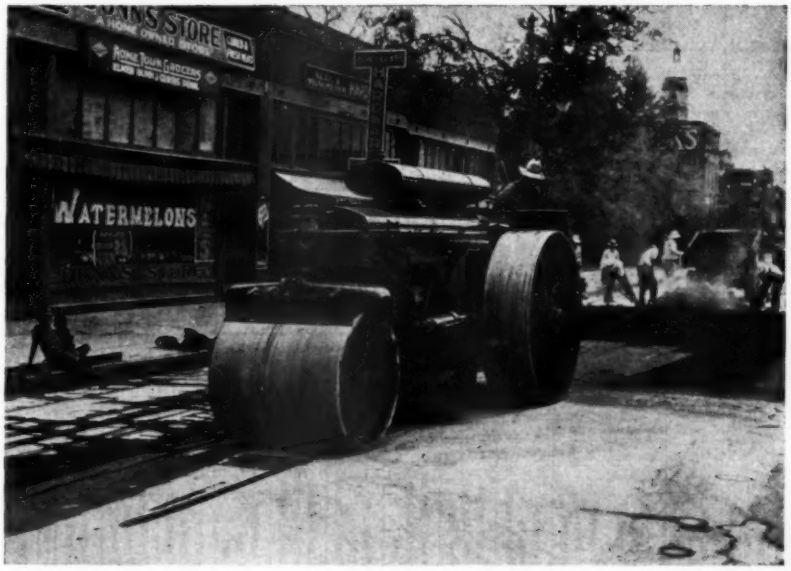
With no definite program at the present time, it is impossible to give an estimate of the number of miles and cost of each type of improvement.

An idea of the division of work to be done in 1937 may be gained from a study of the types of work done in 1936. The following table gives the approximate percentages for last year: grading and culverts, 41; light type surfacing—sand, gravel, or crushed stone, 7; bituminous mat, 14; high type pavement, 19; bridges, 19.

Kentucky

Kentucky will spend $18,200,000 for highway work in 1937, according to preliminary estimates made by R. Y. Fishback, Engineer of Road Design. This is about the same expenditure as last year.

Construction funds amount to $9,200,000; maintenance, $6,000,000; and other work, $3,000,000. Sources of income are as follows: Hayden-Cart-



• *A street construction job in Witchita, Kansas, handled by H. T. Ritchie is shown here. The watching "crowd" at left seems more interested in the Austin-Western Roll-A-Plane than in the possibility of watermelon offered by the store behind them.*

Federal Aid Highway Projects

As of October 31, 1936

STATE	APPORTIONMENT	COMPLETED			UNDER CONSTRUCTION			APPROVED FOR CONSTRUCTION			BALANCE OF FUNDS AVAILABLE FOR NEW PROJECTS
		Estimated Total Cost	Federal Aid	Miles	Estimated Total Cost	Federal Aid	Miles	Estimated Total Cost	Federal Aid	Miles	
	$	$	$		$	$		$	$		$
Alabama	5,208,287				585,592	292,796	23.2	474,000	237,000	13.7	4,678,491
Arizona	3,564,709	1,794,231	1,385,866	98.3	744,298	615,810	21.7	351,723	266,083	18.8	1,296,951
Arkansas	4,275,929							1,070,297	1,069,785	30.0	3,206,144
California	9,508,671	2,717,634	1,570,947	69.0	9,467,091	5,422,502	259.7	2,709,024	1,560,909	55.8	954,313
Colorado	4,575,144	2,175,545	1,216,773	93.4	3,324,311	1,746,114	109.9	1,884,899	1,052,147	72.2	560,111
Connecticut	1,582,913	282,616	141,308	4.8	818,140	406,867	10.3	122,827	61,414	1.4	973,324
Delaware	1,218,750	239,537	119,768	30.3	340,946	170,375	9.9	402,095	194,327	13.0	734,280
Florida	3,315,558	831,120	415,560	27.5	622,727	311,363	19.3	13,828	6,914		2,581,721
Georgia	6,336,443	825,838	405,625	62.4	2,282,251	1,116,807	136.3	854,393	418,082	36.5	4,395,929
Idaho	3,065,304	1,642,180	975,613	201.1	1,522,870	911,284	87.9	689,563	412,629	42.6	765,778
Illinois	10,325,922	3,447,530	1,720,251	72.0	8,101,079	4,016,065	125.1	3,553,230	1,751,190	88.5	2,838,416
Indiana	6,184,258	3,517,770	1,755,240	109.2	2,653,849	1,326,216	96.1	4,189,246	2,093,824	103.3	1,008,978
Iowa	6,466,628	5,055,011	2,386,054	388.3	3,992,495	1,923,329	151.6	2,085,936	1,009,653	68.0	1,147,592
Kansas	6,631,085	2,082,561	1,040,612	409.2	4,449,151	2,198,122	486.4	3,064,318	1,532,090	160.2	1,860,261
Kentucky	4,611,955	2,140,374	1,049,101	139.5	406,528	203,264	14.2	1,238,575	614,842	45.9	2,744,749
Louisiana	3,557,930	1,458,617	729,308	52.9	1,143,103	571,537	38.3	655,364	327,682	16.1	1,929,403
Maine	2,177,197	1,643,303	820,854	48.5	721,452	360,726	21.3	715,448	357,724	14.6	637,893
Maryland	2,050,870				791,731	395,831	11.3	937,600	428,277	12.5	1,226,761
Massachusetts	3,485,364				3,788,933	1,844,467	12.2	1,063,134	531,567	8.5	1,109,331
Michigan	7,668,768	4,082,735	2,037,670	162.4	9,759,918	4,879,434	289.0	1,270,694	635,347	33.6	116,317
Minnesota	6,849,307	7,409,615	3,441,390	472.2	1,971,297	976,460	113.3	1,996,284	998,142	85.3	1,433,315
Mississippi	4,387,636				108,905	54,452	8.1	1,334,523	667,211	79.2	3,665,972
Missouri	7,601,200	2,645,970	1,318,736	364.7	6,447,469	3,222,914	264.7	2,810,227	1,373,248	141.7	1,686,302
Montana	5,122,333	3,649,930	2,043,463	375.7	2,113,657	1,183,437	145.4	1,502,528	803,073	64.4	1,092,360
Nebraska	5,167,930	1,334,766	667,304	106.7	3,552,893	1,782,029	320.7	577,816	288,908	26.3	2,429,689
Nevada	3,189,479	1,342,745	1,157,803	253.7	718,126	620,662	29.4	83,813	72,545	1.1	1,338,468
New Hampshire	1,218,750	734,176	360,712	22.2	179,821	89,585	3.0	196,960	98,317	1.9	670,136
New Jersey	3,352,469	565,970	282,965	12.0	3,642,660	1,734,799	37.0	324,309	162,154	5.4	1,172,550
New Mexico	3,990,023	2,298,579	1,396,900	173.6	1,940,171	1,195,049	160.0	1,265,576	769,714	90.8	628,361
New York	12,306,710	3,669,155	1,816,735	83.0	14,772,034	7,272,967	271.4	2,297,700	1,148,850	26.9	2,068,158
North Carolina	5,879,466	1,500,282	749,559	199.6	2,915,535	1,456,870	291.5	971,681	435,809	43.4	3,237,228
North Dakota	3,918,269				191,740	101,206	.1	208,710	111,743	.3	3,705,319
Ohio	9,131,204	761,780	380,890	12.3	6,443,773	3,105,588	80.7	1,616,442	724,528	11.1	4,920,198
Oklahoma	5,884,927	1,687,839	882,204	60.8	1,817,027	952,592	62.3	1,517,374	741,861	57.2	3,308,270
Oregon	4,089,711	2,197,702	1,324,878	89.5	2,880,855	1,701,691	93.6	967,166	562,452	40.1	500,689
Pennsylvania	10,695,446	4,272,818	2,136,140	73.4	7,778,840	3,881,486	105.8	3,528,590	1,752,706	50.9	2,925,116
Rhode Island	1,218,750				386,963	193,482	5.1	551,309	275,655	4.1	749,614
South Carolina	3,381,337	32,682	15,000	8.7	2,622,757	1,064,493	198.9	1,916,952	804,277	135.2	1,497,567
South Dakota	4,078,647	1,194,361	673,302	157.5	237,222	140,852	35.5	275,011	150,780	20.3	3,113,713
Tennessee	5,268,270	1,792,087	895,471	75.2	909,406	454,693	34.0	209,297	104,648	9.0	3,813,458
Texas	15,548,821	8,141,882	4,062,393	462.4	6,481,241	3,234,685	320.7	695,674	347,173	18.8	7,904,569
Utah	2,826,960	1,781,746	1,276,399	125.6	626,138	450,940	37.4	336,078	213,280	16.3	886,341
Vermont	1,218,750	1,197,797	596,273	59.4	718,663	348,488	20.0	280,100	122,435	6.0	151,554
Virginia	4,559,200	1,291,678	643,584	51.2	2,785,398	1,392,696	116.0	1,999,359	999,676	61.0	1,523,244
Washington	3,304,738	2,976,479	1,567,003	93.3	2,555,685	1,342,471	132.9	516,534	271,400	8.9	723,864
West Virginia	2,716,754	208,599	104,300	9.7	1,279,426	639,694	45.9	841,850	420,925	20.3	1,551,836
Wisconsin	6,090,504	2,851,076	1,378,890	106.7	4,696,563	2,262,758	177.8	649,950	320,345	23.9	2,128,511
Wyoming	3,121,972	2,594,867	1,582,302	305.0	1,283,686	785,173	190.8	34,226	21,790	1.0	732,707
District of Columbia											
Hawaii	1,218,750				467,855	231,167	8.2	69,938	34,754	1.6	952,829
TOTALS	243,750,000	92,071,383	48,525,146	5,722.9	138,042,271	70,586,288	5,233.9	56,922,171	29,359,885	1,887.6	95,278,681

● *Twelve miles southeast of Los Angeles, R. E. Campbell built this section of Olympic Boulevard. In the center of the picture a Caterpillar RD 8 is hauling a LeTourneau 12-yard Carryall scraper, while a second tractor and sheepsfoot roller compact the fill in the foreground.*

wright Act, $4,900,000; other Federal funds, $1,300,000; state gas tax, $10,000,000; vehicle license fees and other sources $2,000,000.

A tentative program of construction is outlined as follows: 75 miles of grading, $1,125,000; 500 miles of gravel or crushed stone surfacing, $1,500,000; 75 miles of oil treatment, $1,125,000; 200 miles of high type paving, $4,000,000; 75 miles of low type paving, $575,000; and 50 bridges to total $875,000.

No highway funds were diverted in 1936. About 1,500,000 yards of previously awarded excavation at a cost of $450,000 will be carried over into 1937.

Louisiana

An increased appropriation makes available $29,600,991 for Louisiana highway work in 1937. Information from Office Engineer J. A. Kinkead, shows that $13,600,991 is allotted to construction; $7,000,000 for a Mississippi River Bridge at Baton Rouge; $3,500,000 for regular maintenance; $2,500,000 for extraordinary maintenance, repairs and resurfacing; and $3,000,000 for Farm-to-Market roads.

The above figures include $1,780,991 in Federal Aid, and state funds of $26,820,000 from the following sources: bond, $17,250,000; special bond, $5,000,000; license and chauffeurs' license, $4,070,000; lubricating oil tax, $500,000.

A further classification shows that $700,000 will be used for grading; $12,800,991 for gravel and paving; and $2,600,000 for bridges other than the Baton Rouge span.

The excavation of 930,000 yards at a cost of $155,000 will be carried over from 1936.

Maine

Since the legislature meets early in 1937, and all expenditures are subject to any legislative act which may be authorized, no definite budget can be outlined for Maine at the present time.

The following approximate amounts, however, are anticipated: 1936 Federal Aid matched with state funds to be placed under contract, $300,000; 1937 Federal Aid and state funds, $2,200,000—approximately 60 per cent of this is already under contract, although not over 25 per cent of the contracted work is completed; 1938 Federal Aid and state funds to match, $2,200,000; Works Program grade crossing funds, $425,000; second class Federal Aid funds matched with state funds, $475,000; third class state funds, $700,000; state aid roads, $1,200,000; bridges, $700,000; maintenance, $2,750,000; bridge maintenance, $200,000.

All Federal Aid, except the grade crossing funds, are from the Hayden-Cartwright Acts of various years. The funds provided by the state to meet Federal Aid will mostly be from bond issues. Third class and state aid roads, maintenance, bridge maintenance, and snow removal will be provided from the general highway fund—made up principally from the state gas tax and vehicle license fees.

Road construction contracts call for both grading and surfacing, and while each contract is based on unit prices for various items of work, statistics showing total amounts of different items for all jobs are not yet compiled. No highway funds were diverted in 1936.

Recapitulation of Data on Construction and Improvement of Farm to Market Roads, Streets and Bridges by WPA and ERA

	Agency		Emergency Work Program (WPA & ERA)	
	WPA	ERA		
1. ROADS—Completed (Miles)				
Paved Roads				
New Construction	3,527	2,934	6,461	
Repairs and Improvement	3,132	15,822	18,954	
Total	6,659	18,756	25,415	
Other Roads				
New Construction	11,613	41,229	52,842	
Repairs and Improvement	39,292	193,935	233,227	
Total	50,905	235,164	286,069	
Total Completed (Miles)				311,484
2. ROADS—Under Construction				
Paved Roads				
New Construction	3,489	.....	.....	
Repairs and Improvement	4,989	.....	.....	
Total	8,478	.....	.....	
Other Roads				
New Construction	17,201	.....	.....	
Repairs and Improvement	45,461	.....	.....	
Total	62,662	.....	.....	
Total Under Construction (Miles)				71,140
GRAND TOTAL (Completed and Underway) (Miles)				382,624
3. BRIDGES				
Completed	7,598	6,957	14,555	
Under Construction	3,839	.....	3,839	
Repairs	.....	9,633	9,633	
TOTAL BRIDGES	11,437	16,590	28,027	
4. STREETS AND ALLEYS				
Completed (Blocks)	57,899	.....	.....	
Under Construction (Blocks)	60,372	.....	.....	
TOTAL BLOCKS	118,271	.....	.....	

Highway Projects—U. S. Works Program

As of October 31, 1936

STATE	APPORTIONMENT	COMPLETED			UNDER CONSTRUCTION			APPROVED FOR CONSTRUCTION			BALANCE OF FUNDS AVAILABLE FOR NEW PROJECTS
		Estimated Total Cost	Works Program Funds	Miles	Estimated Total Cost	Works Program Funds	Miles	Estimated Total Cost	Works Program Funds	Miles	
	$	$	$		$	$		$	$		$
Alabama	4,151,115	954,131	954,131	51.1	3,035,965	3,035,965	77.9	68,086	68,086	8.7	92,932
Arizona	2,569,841	2,091,221	1,900,872	132.9	926,779	589,840	54.6	22,200	22,200	1.6	56,929
Arkansas	3,352,061	2,004,968	1,989,135	186.4	1,242,977	1,239,356	159.0	46,803	46,523	2.7	77,046
California	7,747,928	4,426,917	4,259,564	188.2	3,366,229	3,331,255	65.9	73,063	73,063	1.2	84,046
Colorado	3,395,263	1,392,374	1,390,897	76.5	731,519	731,518	27.6				1,272,849
Connecticut	1,418,709	90,507	89,377	.2	545,855	524,898	5.9	328,018	328,018	9.1	476,416
Delaware	900,310	170,776	168,080	29.2	443,540	414,700	19.9	250,398	171,583	17.7	145,946
Florida	2,597,144	638,166	638,166	27.6	1,704,848	1,704,848	59.8	212,677	212,677	11.6	41,453
Georgia	4,988,967	439,351	438,662	29.0	484,328	484,328	34.5	647,444	647,444	41.7	3,418,533
Idaho	2,222,747	1,436,000	1,418,429	120.3	808,409	771,953	62.9				32,365
Illinois	8,694,009	5,518,233	5,514,724	328.6	2,885,005	2,880,305	122.4	283,526	283,526	20.2	15,454
Indiana	4,941,255	883,857	880,554	38.0	4,180,838	3,960,933	190.5	37,924	37,924	6.3	61,843
Iowa	4,991,664	1,670,760	1,594,689	264.7	3,498,499	3,340,569	239.4	49,826	49,050	8.5	7,356
Kansas	4,994,975	1,720,535	1,720,291	194.5	3,279,778	3,269,967	180.6	4,717	4,717		
Kentucky	3,726,271	1,528,096	1,520,582	197.9	1,389,464	1,389,464	125.0	573,566	573,558	26.5	242,667
Louisiana	2,890,429	628,845	498,243	32.4	2,105,535	1,902,329	119.8	402,579	337,600	22.4	152,257
Maine	1,676,799	1,081,242	1,080,012	45.7	498,618	498,618	24.6	52,100	52,100	1.7	46,069
Maryland	1,750,738	122,867	122,867	7.4	569,657	529,787	10.9	783,659	660,188	23.3	437,896
Massachusetts	3,262,885	50,481	50,481	.6	1,867,213	1,867,213	12.3	337,664	337,664	5.0	1,007,526
Michigan	6,301,414	4,664,500	4,604,470	208.0	1,499,021	1,499,021	76.8	55,700	55,700	4.6	142,223
Minnesota	5,277,145	4,013,661	3,435,080	676.6	2,155,773	1,636,739	224.0	281,464	188,074	9.4	17,252
Mississippi	3,457,552	901,439	900,469	83.1	2,128,679	2,124,212	117.0	159,490	159,490	15.8	273,380
Missouri	6,012,652	3,087,860	3,066,506	668.2	2,451,252	2,345,978	106.4	700,306	532,289	3.1	67,879
Montana	3,676,416	3,093,066	3,093,066	174.0	514,971	514,971	11.3	39,585	31,615	10.0	36,764
Nebraska	3,870,739	1,399,755	1,379,246	153.5	2,151,471	2,125,666	204.2	118,088	118,088	12.2	247,739
Nevada	2,243,074	1,521,413	1,475,055	66.5	485,320	485,320	24.7	2,738	2,738	.3	279,961
New Hampshire	945,225	353,695	350,039	19.4	398,849	376,750	13.2	48,230	48,230	.3	170,206
New Jersey	3,129,805	93,993	93,993	2.2	2,487,986	2,471,831	26.1	508,731	499,762	5.5	64,220
New Mexico	2,871,397	1,777,970	1,777,267	147.0	587,069	587,069	32.6	438,125	438,125	19.1	68,937
New York	11,046,377	4,337,273	4,264,082	83.9	6,790,600	6,450,029	84.0	328,700	328,700	2.5	3,566
North Carolina	4,720,173	900,349	900,349	60.9	3,086,460	3,053,871	204.3	669,686	576,813	21.7	189,140
North Dakota	2,867,245	789,824	789,287	129.5	1,723,545	1,720,520	162.8	225,493	225,493	32.0	131,945
Ohio	7,670,815	1,531,552	1,519,652	45.8	4,560,171	4,426,443	143.6	987,845	958,640	85.6	766,079
Oklahoma	4,580,670	949,097	940,883	82.7	2,426,515	2,423,887	238.1	774,401	767,273	60.0	448,628
Oregon	3,038,642	1,625,881	1,621,006	141.2	1,541,402	1,176,860	15.2	109,669	107,719	10.4	133,057
Pennsylvania	9,347,797	1,196,870	1,135,212	63.0	1,829,646	1,825,608	50.6	1,945,378	1,907,740	68.1	4,479,237
Rhode Island	989,208	682,694	681,082	11.9	298,453	298,453	6.9				9,673
South Carolina	2,702,012	682,189	649,539	74.6	1,497,560	1,441,830	132.8	270,906	266,452	21.1	344,192
South Dakota	2,976,454	1,441,331	1,441,331	315.6	1,084,918	1,084,918	127.0	271,618	271,618	29.0	178,587
Tennessee	4,192,460	1,434,869	1,432,490	66.3	1,417,563	1,417,563	46.2	452,468	452,468	22.8	889,940
Texas	11,989,350	8,682,940	7,886,409	794.7	4,362,446	3,978,228	317.2	76,061	60,475	6.0	64,238
Utah	2,067,154	1,244,273	1,116,701	142.6	778,767	746,853	45.4	33,660	33,660	2.1	169,940
Vermont	924,306	642,881	564,011	16.1	380,536	317,938	5.7	7,880	7,770		34,587
Virginia	3,652,667	2,210,531	2,140,006	719.9	1,066,484	1,060,747	279.7	296,779	295,720	41.3	156,194
Washington	3,026,161	2,385,763	2,168,811	149.4	900,911	742,570	14.1	92,098	92,098	1.2	22,683
West Virginia	2,231,412	194,382	194,382	11.8	1,762,939	1,759,386	65.5	163,409	162,677	12.9	114,967
Wisconsin	4,823,884	3,473,308	3,098,486	247.5	2,029,303	1,720,935	93.2	3,355	3,355	2.9	1,108
Wyoming	2,219,155	1,135,864	1,135,849	96.6	1,003,194	1,003,188	43.4	60,800	41,934	.1	38,184
District of Columbia	949,496	909,101	909,101	8.5	25,011	4,295	.2	25,600	362	.2	35,738
Hawaii	926,033	142,719	129,996	2.6	502,444	494,109	6.3	54,421	53,884	1.5	248,044
TOTALS	195,000,000	84,350,390	81,123,612	7,414.8	87,494,315	83,783,634	4,512.0	13,376,934	12,594,883	709.9	17,497,871

• *Traffic problem! Shovels ordinarily build roads, rather than travel on them. Here, however, O. F. Fisher's Northwest is en route to a highway job in Arizona, meets two of George Orr's Bucyrus-Eries coming out after completing a 350,000-yard contract in tough rock.*

Maryland

A 2 per cent increase in highway funds over last year gives Maryland $19,366,325 for the 1935 highway program. These funds will be used for construction, $12,534,653; maintenance, $2,262,637; and other work, $4,569,035.

Funds for this work will be obtained as follows: Hayden-Cartwright Act, two years, $2,051,740; other Federal funds including balance carried over, $6,172,105; state gas tax, $6,040,062; vehicle license, $5,102,418.

In 1936, $2,596,010 was diverted from the highway budget. This included $1,219,378 paid directly to the city of Baltimore and $598,269 for county debt service.

No detailed program for construction work has been made out at present. 3,000,000 yards of previously awarded excavation at a cost of $1,200,000 will be carried over into 1937.

Massachusetts

Since highway funds are dependent on appropriations made by the legislature, which meets this month, Chief Engineer Delano informs us that it is not possible to forecast the 1937 program for Massachusetts. Available after July 1, will be Federal Aid apportionments for the fiscal year 1938, official figures for which have not yet been announced.

Last year's Federal Aid amounted to $1,750,000, and the Public Works Program provided $3,250,000. In 1936, direct diversion from the highway fund to the general fund was $3,650,000.

In addition to funds shown in the various Bureau of Public Roads tables, the Bureau will administer (with the exception that one-third of funds for forest highways, roads and trails will be expended by the Forest Service) the following funds during the fiscal year beginning July 1, 1937:

Regular Federal Aid	$125,000,000
Forest Highways, Roads and Trails	14,000,000
Public Lands Highways	2,500,000
National Park Highways	7,500,000
Federal Aid for Secondary Roads	25,000,000
Federal Aid for elimination of hazards at grade crossings	50,000,000
Parkways over lands to which U. S. has title	10,000,000
Total	$234,000,000

Michigan

With an expenditure of $29,000,000 in 1936, Michigan closed the largest construction program in its history, according to information received from H. C. Coons, Deputy Commissioner-Chief Engineer of the State Highway Department. Due to the possibility of changes by legislative action, it is not known if the 1937 figure will approximate this amount.

The present known sources of construction funds for 1937 are as follows: unexpended funds or work carried over from Federal Aid, WPA highway and WPA grade crossing programs totaling $4,802,000; regular Federal Aid amounting to $7,605,000; and a grade crossing program amounting to $1,580,000.

This gives a total definite program of $13,987,000 for the year. In addition to this regular construction work, the highway department is anticipating the supervision of the expenditure of $10,000,000 of combined State and WPA grading projects during the coming season. If that program materializes, construction funds will be divided as follows: 590 miles of grading at a cost of $12,315,000; 235 miles of high type paving costing $6,612,000; and 18 bridges and 24 grade separation projects totaling $5,060,000.

Federal funds are anticipated from the Hayden-Cartwright Act, $6,145,000; and WPA and Emergency Relief, $10,847,000. State funds of $13,575,000 will be obtained from the state gas tax.

With the inclusion of $5,000,000 for

• *Last winter's unusual snows have made highway departments particularly conscious of the need for efficient snow removal equipment. The town of Natick, Massachusetts uses the 5-speed Sterling truck, powered with a 100-horsepower motor, shown here to push a Good Roads V-type plow. The truck is also used on general road repair service.*

Grade Crossing Projects—U. S. Works Program

As of October 31, 1936

STATE	APPORTIONMENT	COMPLETED					UNDER CONSTRUCTION					APPROVED FOR CONSTRUCTION					BALANCE OF FUNDS AVAILABLE FOR NEW PROJECTS
		Estimated Total Cost	Works Program Funds	NUMBER			Estimated Total Cost	Works Program Funds	NUMBER			Estimated Total Cost	Works Program Funds	NUMBER			
				Grade Crossings Eliminated by Separation or Relocation	Grade Crossing Structures Reconstructed	Grade Crossings Protected by Signals or Otherwise			Grade Crossings Eliminated by Separation or Relocation	Grade Crossing Structures Reconstructed	Grade Crossings Protected by Signals or Otherwise			Grade Crossings Eliminated by Separation or Relocation	Grade Crossing Structures Reconstructed	Grade Crossings Protected by Signals or Otherwise	
Alabama	$ 4,034,617	$ 440,449	$ 440,449	7		4	$ 2,984,188	$ 2,984,188	30			$ 474,535	$ 474,535	4		8	$ 135,445
Arizona	1,256,099	398,678	394,444	5			723,342	711,895	7			63,200	63,200	1			86,558
Arkansas	3,574,060	1,082,359	1,078,173	26	3		1,764,681	1,761,558	25	2		662,597	661,542	8	1	29	52,788
California	7,486,362	2,637,534	2,531,037	17	6		4,776,686	4,638,899	34	2							316,426
Colorado	2,631,567	926,063	905,063	18			639,929	639,929	6	1		380,629	380,600	3			705,975
Connecticut	1,712,684						563,087	491,009	3	1	1	494,014	494,014	1	2		727,661
Delaware	418,239						143,486	120,000	1								298,239
Florida	2,827,583	660,331	658,600	5	4		1,334,594	1,334,014	15	2		396,932	396,932	9			438,337
Georgia	4,895,949	12,090	12,090	1			318,336	318,336	5	2		546,193	546,193	17			4,019,330
Idaho	1,674,479	800,908	800,908	12	1		315,924	315,924	5			153,291	153,291	1		18	404,355
Illinois	10,307,184	1,193,414	1,193,414	16			6,452,415	6,452,415	39	3		1,507,983	1,507,983	9	2		1,153,372
Indiana	5,111,096	241,288	241,288	4			4,629,802	4,506,683	33	11		405,820	354,820			162	8,306
Iowa	5,600,679	835,749	802,534	25	2		4,167,065	4,117,883	73	7		610,765	599,350	9		8	80,912
Kansas	5,246,258	595,723	595,723	8			4,577,171	4,521,743	44	1		128,792	128,792	3		3	
Kentucky	3,672,387	111,700	111,700	4			2,561,827	2,272,095	18	2		156,898	156,898	1	2		1,131,694
Louisiana	3,213,467						1,447,148	1,447,148	13	1		967,081	922,616	8	3		843,703
Maine	1,426,861	385,978	385,645	11			700,536	699,945	9			81,675	81,675	1		2	259,596
Maryland	2,061,751						477,688	469,649	4	2		1,064,147	1,041,679	4	2	19	550,423
Massachusetts	4,210,833	117,449	117,449	2			1,977,105	1,977,105	15	2		1,034,152	1,034,152	5	2		1,082,128
Michigan	6,765,197	1,492,775	1,492,775	19	4		5,056,377	5,011,877	24	3		237,120	237,120		1		23,425
Minnesota	5,395,441	1,460,138	1,459,792	43	4	36	3,679,391	3,484,020	43	5	5	145,800	145,800		2	1	305,828
Mississippi	3,241,475	171,046	171,046	8	1		2,333,513	2,333,513	41	2	1	83,000	83,000	5		3	653,916
Missouri	6,142,153	261,639	261,639	5			5,580,301	5,479,026	40			367,252	253,300	1		2	148,187
Montana	2,722,327	2,010,499	2,010,499	30	6		649,819	649,819	7								62,009
Nebraska	3,556,441	1,051,080	1,051,080	43			1,973,990	1,973,990	33	1	5	434,876	434,876	4	1	18	96,496
Nevada	887,260	306,096	306,096	7			599,335	577,534	3	1		3,630	3,630			5	
New Hampshire	822,484	151,745	151,745	1	2		350,493	350,493	6	2	1						320,246
New Jersey	3,983,826	59,838	59,838		1		1,836,798	1,825,753	14	1		708,283	708,283	3	1		1,389,953
New Mexico	1,725,286	532,909	532,909	10			925,812	925,812	6	1		72,214	72,214	1			194,352
New York	13,577,189	637,207	637,207	2	3		9,910,837	9,649,991	31	33		1,467,700	1,467,700	7	5		1,822,291
North Carolina	4,823,958	476,941	476,941	7	5		2,009,985	2,009,985	25	8		1,114,596	1,099,096	11	5	61	1,237,936
North Dakota	3,207,473	210,034	210,034	5			1,824,361	1,823,361	36	1		217,540	217,540	4	3		956,537
Ohio	8,439,897						3,677,330	3,464,031	24	2		2,942,293	2,793,989	15	3		2,181,877
Oklahoma	5,004,711	1,208,387	1,208,387	26	1		1,680,402	1,680,402	18	2		568,379	568,379	7	3		1,547,543
Oregon	2,334,204	335,153	335,153	4	3		2,071,153	1,943,537	12	3		41,500	41,500	1		2	14,013
Pennsylvania	11,483,613	390,192	338,959	17			5,673,422	5,163,635	35	15		2,745,070	2,703,208	13	1		3,277,810
Rhode Island	699,691	236,879	236,879		1		418,195	417,129	4			21,195	21,195		1		24,488
South Carolina	3,059,956	273,675	270,371	9		3	1,539,890	1,524,538	28	7		259,614	259,489	1	1	50	1,005,558
South Dakota	3,249,086	435,409	435,409	17			1,633,542	1,633,542	34	3	11	291,116	291,116	5		19	889,019
Tennessee	3,903,979	254,476	254,476	7		4	1,142,547	1,142,547	14	2	2	673,662	673,662	9	1	16	1,833,294
Texas	10,855,982	1,942,453	1,942,453	34	6		7,347,903	7,341,526	83	8		1,264,951	1,211,992	7	1	167	360,010
Utah	1,230,763	87,218	85,829	1	1		1,015,391	998,743	12			93,695	93,695	2			52,496
Vermont	729,857	462,107	458,624	7	5		172,547	157,272	1	1	4	75,853	44,324	2		9	69,638
Virginia	3,774,287	532,655	532,655	19	1		1,484,508	1,374,642	19	5		662,182	662,178	14	3	12	1,204,812
Washington	3,095,041	691,778	686,978	12	3	5	2,141,128	2,140,703	10	8		4,290	4,290			2	263,070
West Virginia	2,677,937						1,211,697	1,211,673	11	2		495,561	495,561	10	1	4	970,703
Wisconsin	5,022,683	793,936	793,936	12	1		3,653,409	3,588,328	24	5							640,418
Wyoming	1,360,841	251,237	251,131	4			798,106	798,101	7			65,000	30,000	1			281,609
Dist. of Columbia	410,804						425,564	396,804	3								14,000
Hawaii	453,703						522,380	453,703	5								
TOTALS	196,000,000	27,157,215	26,921,358	510	64	52	113,915,136	111,326,451	1032	160	30	24,185,076	23,615,409	207	47	620	34,136,782

maintenance, it is estimated that total expenditures will be $5,000,000 less than last year. In 1936 no highway funds were diverted in Michigan.

Minnesota

About $22,000,000 will be spent for highway work in Minnesota in 1937, according to estimates made by O. L. Kipp, Construction Engineer of the Department of Highways. This represents a decrease of 35 per cent from 1936 expenditures. Construction work will total $15,000,000 and maintenance will require $7,000,000.

The total sum will be obtained from the following sources: Federal Aid, $6,700,000; other Federal funds, $300,000; state gas tax, $7,500,000; and state vehicle license fees and other $7,500,000. It is expected that the entire budget will be used for highway purposes, as no funds were diverted in 1936.

In addition to the above amounts, 3,400,000 yards of previously awarded highway excavation work at a cost of $1,400,000 will be carried over into 1937.

A varied program for the available construction funds has been outlined as follows: 450 miles of grading at a cost of $4,500,000 and involving 11,000,000 yards of material; 300 miles of gravel or crushed stone, $1,500,000; 250 miles of oil treatment, $500,000; 80 miles of high type paving, $2,500,000; 200 miles of low type paving, $1,000,000; 50 bridges, $2,000,000; and right of way and engineering supervision, $3,000,000.

Mississippi

With approximately the same highway expenditures as last year, Mississippi will have $25,500,000 available for highway work in 1937, according to E. D. Kenna, Director, State Highway, Department.

Projects involving construction will take $23,000,000; maintenance, $1,500,000; and other highway work will total $1,000,000. These funds will be obtained as follows: Hayden-Cartwright Act, $2,200,000; other Federal funds, $20,150,000; state gas tax, $3,000,000; and vehicle license fees, etc., $150,000.

No gravel or crushed stone or oil treatment is planned in the year's program. Funds will be allocated as follows: 400 miles of grading at a cost of $5,000,000, involving 8,800,000 yards of material; 700 miles of high type paving, $15,800,000; 25 miles of low type paving, $200,000; and 150 bridges at a total cost of $2,000,000.

Contracts previously awarded and which will be carried over into 1937 involve the excavation of 10,000,000 yards at a cost of $2,200,000.

Missouri

A decrease of 50 per cent from 1936 expenditures means a sharp curtailment in the highway program for Missouri in 1937.

Funds available will come from the following sources: Hayden-Cartwright Act, $8,000,000; other Federal funds, $500,000; state gas tax, $10,000,000; and vehicle license fees, $7,500,000.

Construction funds allotted amount to $12,000,000 and maintenance, $5,000,000. Plans for the division of work have not been completed.

(Continued on Page 50)

Forest Highway Funds

From Statement by Bureau of Public Roads as of October 31, 1936

STATES	PROGRAMMED WORK: Under Construction	Not Under Construction: Under Contract	Not Under Construction: Not Under Contract	TOTAL	Balances Available for Programming	GRAND TOTAL
Alabama	—	—	—	—	.39	.39
Alaska	454,900.00	149,400.00	200,000.00	804,300.00	506,829.77	1,311,129.77
Arizona	452,794.00	—	75,000.00	527,794.00	44,603.13	572,397.13
Arkansas	—	—	130,025.00	130,025.00	9,173.42	139,198.42
California	435,075.00	—	504,300.00	939,375.00	93,839.02	1,033,214.02
Colorado	27,779.00	99,581.00	95,000.00	222,360.00	34,131.98	256,491.98
Florida	29,875.00	—	36,914.00	66,789.00	.10	66,789.10
Georgia	59,764.00	15,099.00	13,366.00	88,229.00	960.91	89,189.91
Idaho	471,500.00	—	206,000.00	677,500.00	63,058.13	740,558.13
Illinois	—	14,954.00	—	14,954.00	356.13	15,310.13
Indiana	—	—	—	—	1,629.54	1,629.54
Kentucky	—	—	—	—	16,482.66	16,482.66
Louisiana	—	—	—	—	13,932.27	13,932.27
Michigan	38,250.00	14,623.00	37,592.00	90,465.00	10,371.38	100,836.38
Minnesota	134,434.00	—	68,700.00	203,134.00	10,092.54	213,226.54
Missouri	—	—	—	—	29,989.16	29,989.16
Montana	288,000.00	87,000.00	150,000.00	525,000.00	73,704.65	598,704.65
Nebraska	—	—	28,080.00	28,080.00	7,831.87	35,911.87
Nevada	—	10,000.00	100,000.00	110,000.00	9,402.79	119,402.79
New Hampshire	125,931.00	—	—	125,931.00	39,941.47	165,872.47
New Mexico	93,357.00	—	192,091.00	285,448.00	21,966.42	307,414.42
North Carolina	—	—	57,735.00	57,735.00	4,543.37	62,278.37
Ohio	—	—	—	—	1,525.59	1,525.59
Oklahoma	—	3,244.00	—	3,244.00	5,738.29	8,982.29
Oregon	1,043,000.00	222,000.00	100,000.00	1,365,000.00	137,685.24	1,502,685.24
Pennsylvania	—	—	16,424.00	16,424.00	665.06	17,089.06
Puerto Rico	—	—	—	—	1,124.64	1,124.64
South Carolina	3,850.00	1,700.00	1,550.00	7,100.00	18,442.42	25,542.42
South Dakota	55,894.00	—	—	55,894.00	6,256.82	62,150.82
Tennessee	20,797.00	—	16,020.00	36,817.00	3,939.22	40,756.22
Texas	—	—	—	—	21,551.31	21,551.31
Utah	118,456.00	—	—	118,456.00	12,417.48	130,873.48
Virginia	—	—	31,509.00	31,509.00	487.18	31,996.18
Washington	421,000.00	—	190,000.00	611,000.00	63,795.53	674,795.53
West Virginia	43,872.00	—	13,067.00	56,939.00	2,558.56	59,497.56
Wisconsin	—	—	33,467.00	33,467.00	10,423.39	43,890.39
Wyoming	213,483.00	—	85,000.00	298,483.00	41,934.93	340,417.93
TOTAL	$4,532,011.00	$617,601.00	$2,381,840.00	$7,531,452.00	$1,321,386.76	$8,852,838.76

There are 48,000 communities in the United States which have no railroad service and whose only lanes of land transportation are highways, according to Roy F. Britton, Director of the National Highway Users Conference. At the same time, two thirds of our 3,000,000 miles of highways are totally unimproved, only about 400,000 are surfaced, and only a small fraction of these are really adequate for modern high speed travel.

• *A recent interesting job handled by Megarry Brothers is illustrated here. Equipped with Hercules (Red Strand) wire rope, their 1-yard dragline handled 180,000 yards on a 75-mile job on highway No. 4, near Lake Henry, Minnesota. Just what part the crops shown played in the work, we're not sure.*

A Small Shovel's Two-Faced Performance

Orino, Berkemeier & Saremal use 3/8-yard machine working both ends of a tunnel at once.

By HENRY W. YOUNG

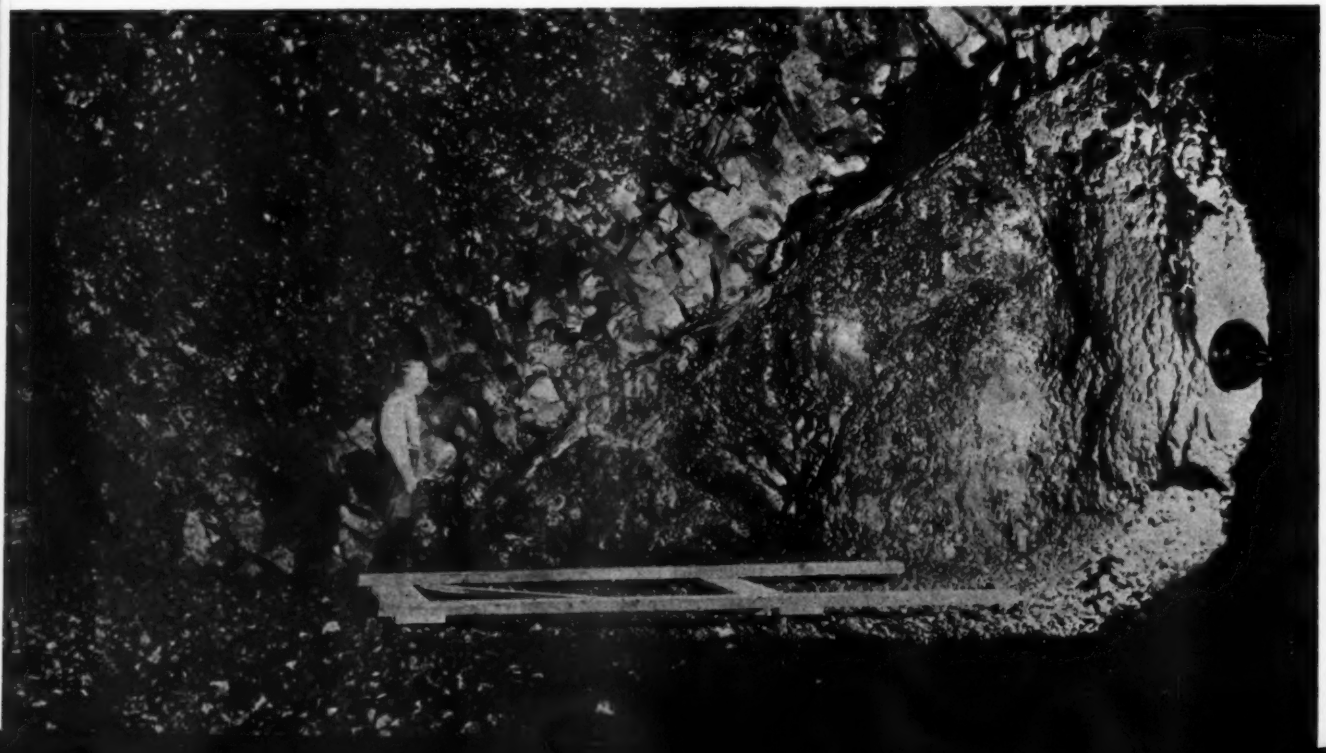
AN excellent example of small shovel adaptability may be found on a tunnel job now nearing completion on the Columbia River Highway. This is known as Tooth Rock Tunnel, and is located about a mile above Bonneville, in connection with a reconstructed section of the famous highway made necessary by the construction of Bonneville Dam. Contractors Orino, Birkemeier & Saremal, of Bonneville, Oregon, have the contract, the amount being $225,000. The work is being done for the U. S. Bureau of Public Roads.

The complete tunnel will be 827 ft. long, carrying a 26 ft. roadway plus a four ft. sidewalk on each side. The total height is 21 ft. 7 inches, with a radius of 17 feet from the spring line. These are inside dimensions. Outside of them will be a reinforced concrete lining a foot thick. There will be a 4 per cent grade in through the tunnel, with a 1600 foot vertical curve, in addition to a 0°2'30" curve at the west entrance tangent to the alignment.

The photographs shown were taken late in September when the face at the east end was in about 300 feet and that at the west end about 30 feet. This was when a Bucyrus-Erie 3/8-yard 10-B was discovered handling both ends of the tunnel. Coming upon it first at the west end, I found it excavating just outside the portal for the foundation of a short viaduct which was to support the approach on the river side.

Directly behind the shovel was an almost straight drop of 100 feet to the river, and the material looked none too stable. The whole width from the bank at the right over to the drop off would have made just a comfortable footing for a big shovel if it kept its boom well up. The little fellow was "in a hole," all right, but one of its own making. It was keeping two 5-yard trucks busy on a short haul, and they were able to back in close beside the shovel in a space which would have been entirely filled by a large shovel.

Just as the 10-B was finishing up this piece of work, muffled reports announced that the east face had been shot down again and that work would be waiting there for an ambitious shovel. With a few farewell roots of its 3/8-yard dipper, the 10-B swarmed up out of the hole and on to the grade to wait for its trailer. The rear wheels and supporting frame of the latter were swung around, fronting down the road, and by the aid of some frog-like blocking



• *Fig. 1—Showing the peculiar formation of rock typical of a large portion of the tunnel.*

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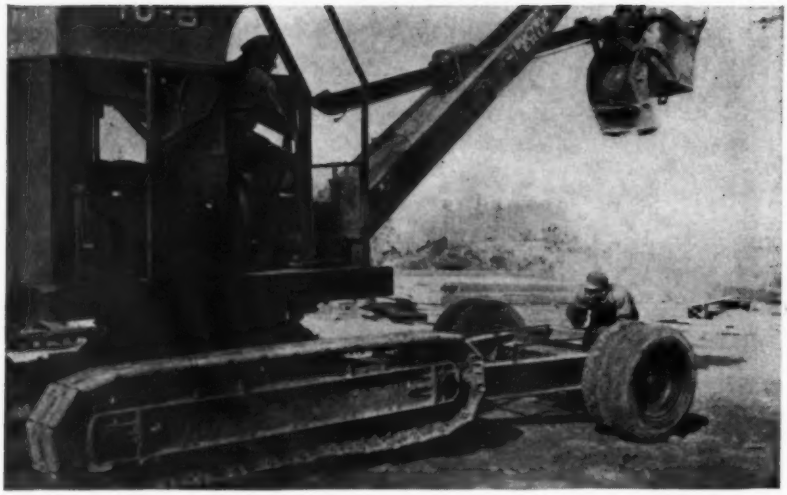
• *Fig. 2 top—The little shovel had got itself "into a hole," but one of its own digging.*
• *Fig. 3 center—Close-up of a water liner in action from the top staging of the Jumbo.*
• *Fig. 4 bottom—"While the truck is getting up, I'll just clean out this corner."*



• *Fig. 5—Gracefully squats on the trailer frame and waits to be tucked in.*

the shovel backed up under its own power and gracefully squatted on the frame (Fig. 5), the dipper swinging around to the rear and deftly helping here and there by way of hitching up its own pants, so to speak. Then the front wheels were brought around and the jacking up process gone through with until the crawlers of the shovel were well clear of the ground and the machine ready to go. The whole process took only a handful of minutes.

One of the trucks was ready and waiting to be coupled on, and presently the cavalcade was off, (Fig. 6). To go back down the grade, get onto the old highway and proceed around to the east face would take the shovel some little time, as it was a considerable, round-about trip. So the observer took a short way over to see what was going on at that point. Fumes were just clearing out of the tunnel, and it was possible to go back in and find that a large mass of rock had been shot down from the face. This was a variety of diced rock with some chunks about a foot in diameter.

What the Face Is Like

As there were still a few minutes before the 10-B got around from its free-wheeling trip, the time was employed in finding out how they are driving this tunnel and through what.

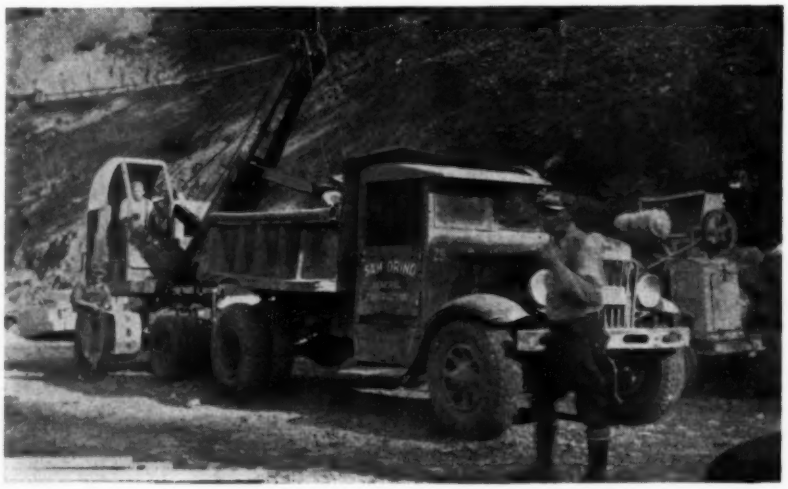
A glance at the photograph of the face (Fig. 1) discloses a rather unusual formation. There is a stratum of solid rock which dips down across the face at a sharp angle. This is basaltic rock, hard in texture, and it breaks rather large. At the left of it is a variety of diced rock, not much of it breaking over four or five inches in diameter. In the lower right hand corner is rotten rock interspersed with mud seams and pockets.

The face is drilled with Ingersoll-Rand 174 water liners, worked from a jumbo mounted on a truck and backed in to the face. (Fig. 8.) This jumbo has two platforms and the water liners are mounted on a frame of heavy pipe. Six are used at a time. One is seen in operation close up (Fig. 3).

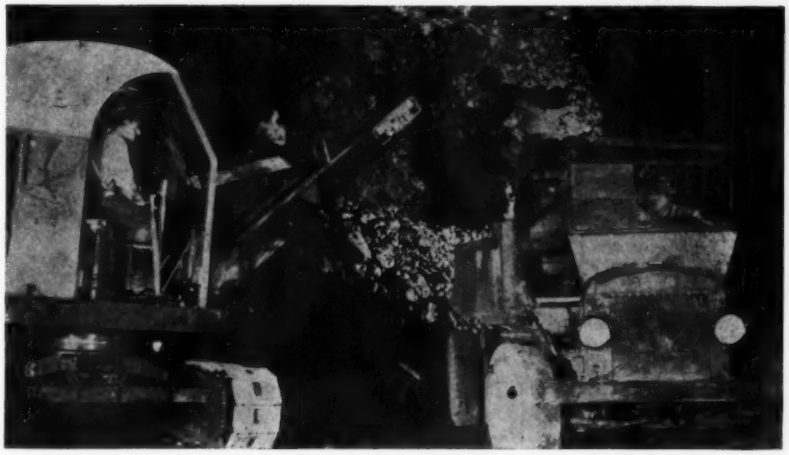
From 65 to 80 6-foot length holes are drilled, including lifters, cuts and straights, and light charges are employed. There is less overbreak for one reason, and also there a railroad tunnel and tracks almost directly below, as well as a temporary truss bridge over the east entrance to carry part of the present highway during construction of the tunnel. Atlas Giant Special gelatin, 40 per cent is being used, fired off the 220 volt line with Du Pont No. 1-No. 10 delay caps. This procedure gets down plenty of rock for several hours of mucking out.

At both portals, however, there is material of a different character, which would not support itself and made it necessary to timber in for a short distance. At the west end an unusual method was followed to get the face started. Side drifts and top heading were first driven in to a distance of about 30 feet. Starting at the inner end of the heading, the arch was ringed out and the first set of arch timbers placed. Then the arch was ringed out completely and timbers set in a backward direction toward the portal of the tunnel. This left a center core in the bore which was taken out after the timbers were all set. The timbers were all 12 inches by 12 inches with two plumb posts and nine 6-foot segments.

Air is supplied for drilling by a portable gas driven Gardner-



• *Fig. 6—Off for a free ride around to the other end of the tunnel.*



• *Fig. 7 — With short, quick swings, ⅜ of a yard at a dipperful, the truck is soon loaded.*

Denver Model AA Form 2002 compressor at the west end. The east end plant consists of two Ingersoll-Rand Imperial Type 40 motor-driven compressors. A pipe line is carried around the rock from the latter so that its output can supplement that of the smaller plant at the other end. A drill sharpening plant has also been set up at the east end, containing one Ingersoll-Rand 44 drill sharpener. Fumes are blown out of the east end by means of a B. F. Sturtevant 60-inch motor-driven blower mounted at the entrance and delivering to a duct built of ply-wood about three feet by three feet in cross-section, which is carried back to a point near the working face.

For Maximum Visibility

The 10-B is just heaving in sight, coming up the east grade, but there is still time to say this much more about the tunnel. It will be electrically lighted by means of sodium vapor lamps. The brilliancy, however, will be regulated automatically by means of an "electric eye." In bright sunlight, the lamps will burn at greatest brilliancy. At sundown and during dark days they will be dimmed down, and at night will be lowest of all.

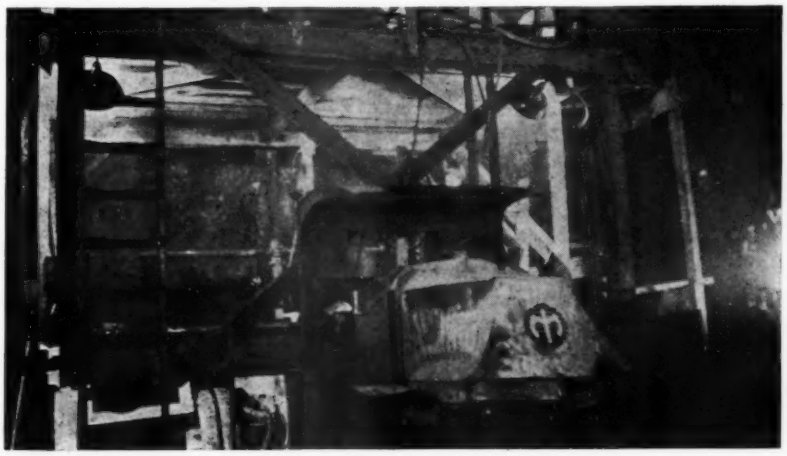
It is during the brightest days that the driver needs the light most. He is looking toward the sun much of the time and the pupils of his eyes are contracted to the maximum then. Suddenly he blasts into the tunnel, and if the lights are dimmed at that time he is partially blinded before his eyes can adjust themselves to the transition. Result—he hugs the middle of the road and there is danger. This is especially true here, since the curve will prevent him seeing through to the other end. Therefore, bright days, bright lights. At night, his headlights are about all that will be needed and the tunnel lights are turned low.

Sweeping In On the Job

But the truck has now dropped the shovel at the entrance and it is making its way into the tunnel under its own power. As it approaches the face, where the down rock has been blown outward some distance, it carefully sweeps a path for itself with the dipper and considerately does the same for the trucks which are to back in along side it. That over, it carefully digs out a corner (Fig. 4) and moves the material over to the right. By now, the truck has backed in (Fig. 7) and the shovel goes to work in earnest. With its short swing and the speed with which it can be manipulated, the 10-B fairly eats up the work in these close quarters. The truck is loaded in a very short space of time and with a parting push on its rump from the dipper is on its way out and another is backed in along side.

There is considerable single track work for the trucks, and consequent delays in spotting. D. H. Cadmus, resident engineer, states that the shovel under these conditions loads from thirty to forty yards per hour. But when trucks have occasionally been spotted fast enough he has checked it up to sixty yards per hour.

The drilling of the face and the loading of holes takes several hours, approximately the same length of time as mucking out. So it happens in the case of this length of tunnel and roadway from one end to the other, that the shovel can muck out one end while the other is being drilled and shot. It then hurries around and repeats the performance at the other end. The contractors say that this works out fine from the economy standpoint, under this particular set of conditions, while the 10-B says nothing and just tends to business.



• *Fig. 8—Jumbo rig from which the water liners were operated.*

• *The big walking dragline is used to strip overburden, as well as load gold-bearing material to the barge.*

Making Record Yardage at John Day

Bucyrus-Monighan 5-W Walking Dragline Produces 8,000 Cubic Yard Outputs in 24-Hour Day on Placer Gold Mining Work

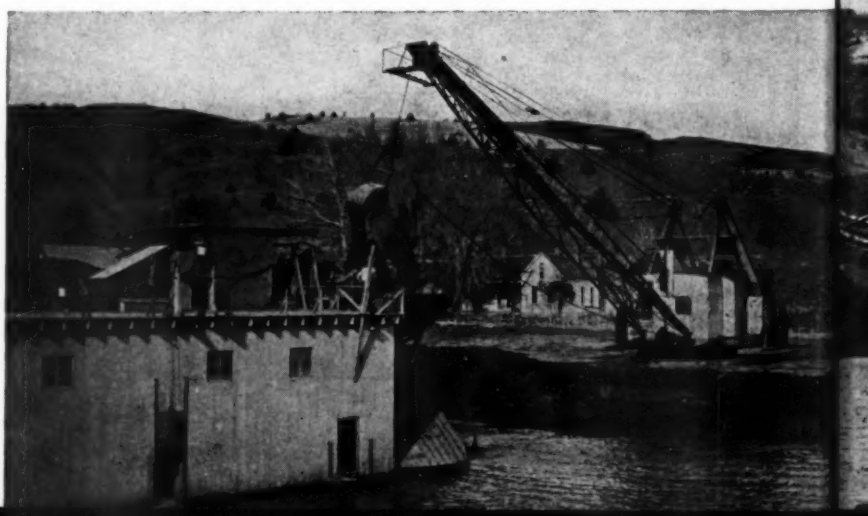
By DAVID W. EVANS

THE Alaska Gold Rush in the "days of '98" has inspired countless stories, and has long since taken its place as an epic part of American history. Although that history may not hitherto have accorded him mention, Joe Ferris was up there, along the Yukon, with the rest of the real sourdoughs. His colorful history has enough sparkle, enough of bold adventure, to make any dirt mover sit up and take notice; but we are here to relate the more matter-of-fact tale of his job at John Day, Oregon, where he and his partner, J. W. Marchbank, are writing placer mining history with a 4-yard dragline bucket.

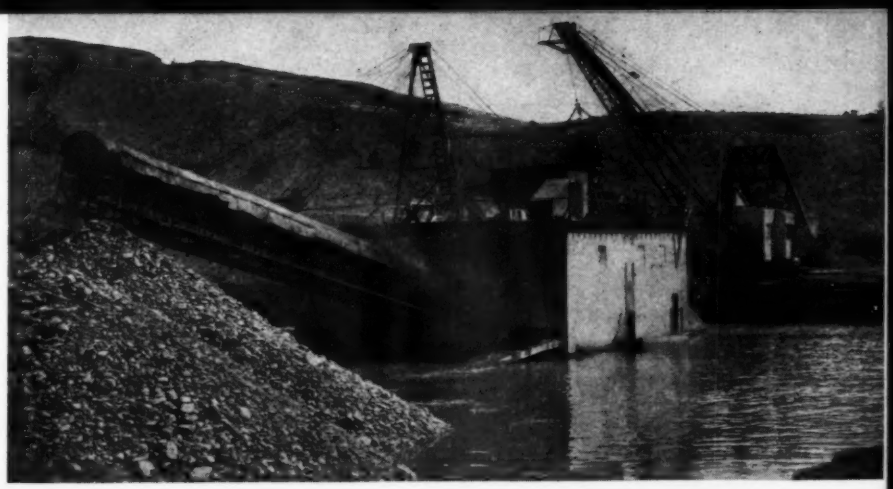
Joe Ferris was one of a group of hard-bitten mining men who inaugurated a new method of diggind gold near Oroville, California, about three years ago. Known as "doodlebug" mining, the method has already been discussed in "Excavating Engineer." This same Joe Ferris, in partnership with D. P. Kumle, was responsible for the article appearing in our issue of May, 1936, describing their operation at Valley Springs, California.

In Grant County, Oregon, near the town of John Day, Ferris and Marchbank started in May, 1935, a placer operation which for volume of output obtained is the largest of the thirty similar jobs inspired by that start at Orville three years ago, and is probably the biggest operation of this sort anywhere in the world.

The site selected, at an altitude of 4,000 feet, had been a rather poor quality farm through which ran a small stream. The area selected follows the path of this stream, operations covering a width of about 800 feet and extending for a distance of 7 miles along it.



• *Four more yards of "pay dirt" go into the hopper of the barge. An average of 8,000 yards per three-shift day is maintained with this equipment.*



• *After the gold has been washed from the gravel, the latter is wasted by a belt conveyor. Operation of the barge is practically automatic.*

Erected on the site was the floating washing plant, with a steel hull 40x70 feet, known as a barge. The washing machinery, including a revolving screen 8 feet in diameter by 50 feet long, with ⅜-inch holes; a receiving hopper with grizzly over it; riffles, pump, Diesel engine for power and belt conveyor for discharging tailings, was built by Bodinson Manufacturing Company of San Francisco, whose quality workmanship has merited them a large share of all such machinery now in use in the placer deposits of the three Pacific Coast states.

As much of the area of placer gravel to be excavated was covered by overburden and brush, a Caterpillar Forty Diesel tractor with bulldozer was purchased for stripping and clearing and to level off the ground ahead of the dragline.

Bucyrus-Erie Dragline Moves 7,000 Cubic Yards a Day

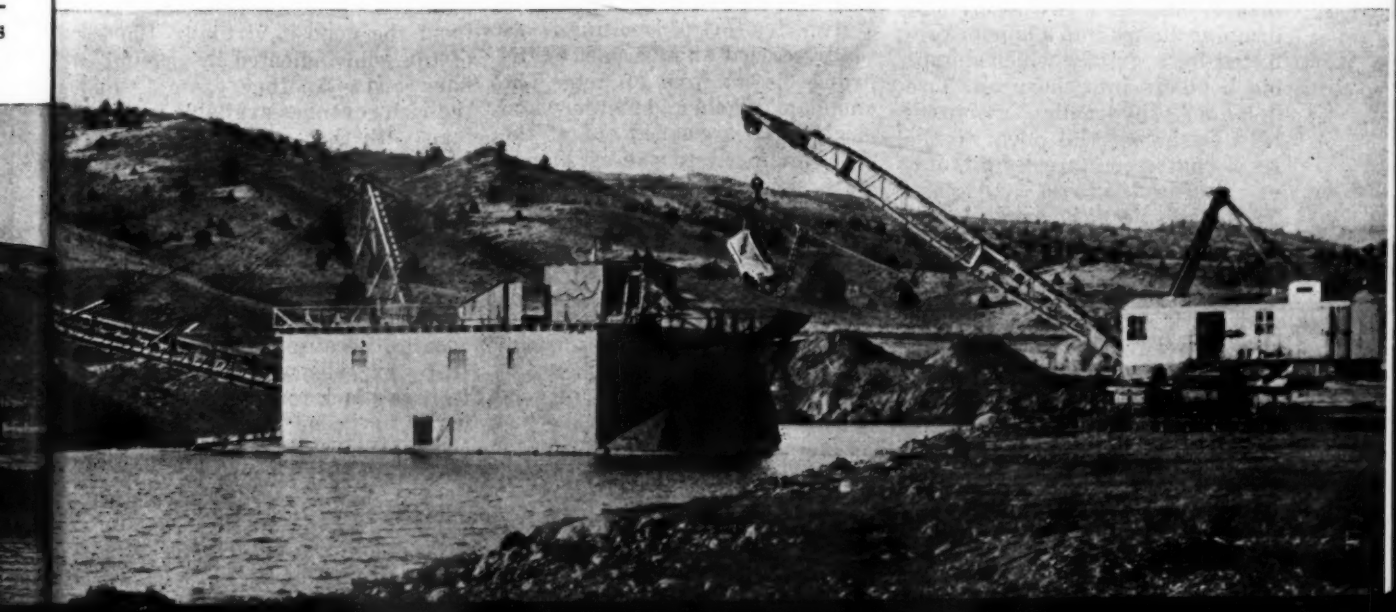
For the major excavation of the deposit, to handle gravel running 10 to 12 feet in depth, a Bucyrus-Erie Class 111 Diesel Dragline was purchased, the machine being operated on a 3-shift basis and working on the average 20 hours per day. Its outputs ranged up to 7,000 cubic yards a day, but as the washing plant, powered by a 6 cylinder 8x9½ Atlas Diesel engine, was not being worked to capacity; and as soft ground conditions were causing some difficulty in maneuvering the dragline; and as overburden ranging from 3 to 5 feet in depth was too much for the tractor to handle, a Bucyrus-Monighan 5-W Diesel dragline was purchased to handle the primary excavation.

Soft Ground Requires New Walking Dragline

This machine, in operation, rests on a large circular base eliminating difficulties due to soft ground. Equipped with a 4-yard bucket and an 80-foot boom it handles cuts of 40 to 45 feet in width. It has consistently loaded 8,000 yards per day into the hopper of the floating washing plant, thus materially increasing the "take" from the bi-weekly clean-ups.

Welding Equipment Vital to Success

A vital part of these placer operations is the welding necessary to keep the job going at top efficiency. Two 330-ampere General Electric welders, driven by gas engines, are used one shift per day for building up dragline bucket teeth and lips, screens, rollers, etc. Another G. E. welder, mounted on the 5-W dragline and driven by an electric motor used for the swing machinery is available for extra duty. While test holes indicate fairly uniform values throughout the depth of gravel excavated, richest returns come from the ground immediately above bedrock. Because this must be cleaned carefully it is vital that dragline bucket lips and teeth be kept in perfect shape. This work is what principally occupies the welders, one welder spending 8 hours a day building up teeth with "Studite." Manganese steel lips of special contour are used on the buckets, special manganese welding rod being used to restore these lips to correct shape for cleaning up the bedrock. Four dragline buckets,



• *A broadside view of early operations. Soft ground later made replacement of the Class III dragline by the "walker" advisable.*

• *The dragline is shown here taking a step to a new position. Operating on a broad, circular base, the machine has had no trouble with the soft ground.*

three Page and one Esco, are in use. Buckets are changed every week to be kept in good repair. The operation has been equipped with a complete shop, including lathe, shaper, drill press, compressor, threading machine and a Lincoln welder.

In charge of the operations at John Day is Superintendent C. Creedon, whose mechanical skill has been very valuable in keeping the operation going smoothly. Assisting him are a bookkeeper, a mechanic, two welders, a tractor operator, office manager, three operators and oilers for the 5-W walking dragline, an operator on the "boat" for each of the three shifts, two welders for one shift. Night foreman is Ralph Wooden.

Operation of the "boat" is virtually automatic, one attendant on each shift being required to insure that all is in order. The dragline dumps into a hopper protected by a grizzly which dumps big boulders into the pond. Two "giants," hydraulic monitors, help wash material down to the revolving screen, break up lumps of cemented gravel and clay. From the screen the smaller sizes of material discharge over the riffles, where a sizable investment in mercury absorbs the fine gold and black sand. Larger sizes of the gravel pass from the discharge end of the screen to the tailings conveyor, are carried back to the tailings pile. The Diesel engine operates a pump which furnishes water for washing and for the two monitors playing on the hopper. In addition the engine drives the screen through gearing and chain drives.

Crude Smelter Proves Efficient

While the steady dumping of the bucket of the big Bucyrus-Monighan into the hopper of the floating washing plant is the outstanding visible feature of the big yardage operation at John Day, actual financing of the operation naturally comes from the gold values recovered in the periodic "cleanups." While this operation, aside from its record daily yardages, is typical of all such placer operations, the fact that a primitive sort of smelting is actually carried on as a part of the project is an item of note. The amalgam of gold and mercury and black sand is cleaned out of the riffles and put into a retort known on the job as "Long Tom." A fundamentally sound-in-principle condenser drives off the mercury as a vapor from the amalgam through applied heat, the process taking place in a pipe within a pipe, the outer cylinder containing cooling water. Valued at $90 per flask, the mercury recovered is used over and over in the riffles on the "boat" to capture the gold, and although the retort used to reclaim it might be classed as primitive, it is effective in that no measurable loss of mercury occurs in the periodic reclamations.

Record 8,000 Cu. Yd. per Day Output Without Visible Effort

Operating smoothly under the careful management of Superintendent Creedon, this project of Ferris & Marchbank at John Day, Oregon, does not seem in any visible respect to be spectacular. Yet while the Bucyrus-Monighan 5-W dragline serenely yet surely dumps its bucket loads into the hopper of the plant; while the welders wield their torches to rebuild buckets from the wear 8,000 cubic yards of gravel a day causes; while the monitors and screen pour their precious cargo in unceasing stream down over the riffles; this efficient, carefully managed operation is reclaiming from the deposit virtually 100% of the gold indicated by preliminary tests—another example of the rich revenues available to any man with the courage and experience to plan an efficient method of excavating—and to select for its execution the best and most reliable equipment available to insure the necessary continuous operation with the absolute minimum of expensive shut-downs for repairs. Because they have learned by experience how to deserve it, here's luck to Ferris & Marchbank for a successful finish to their John Day operation.

Works Program Forecast

By Lt. Col. John H. Carruth

Director Highway and Bridge Division
of Engineering Division Works
Progress Administration

THE WORKS PROGRAM now being executed by the Works Progress Administration is nearing completion, due to the fact that funds to carry on the program of work relief will be exhausted within a few more months. Whether the program will be continued until June 30, 1937 or later, and the nature and extent of any future program, are questions which must be decided by Congress and, if decided affirmatively, put into effect by appropriate legislation.

For these reasons, and also because the details of the execution of each state WPA program are necessarily left to the judgment and initiative of the state Works Progress Administrator, it is not practicable, at this time, to definitely chart the 1937 road construction program of the WPA for the country as a whole.

This much, however, is certain —whatever the nature and extent of the Works Program may be during 1937, the work of construction and improvement of roads, highways, bridges, culverts and viaducts will continue to occupy, as they have up to this time, a very important place in the program. There are two principal reasons for this: first, construction projects of this type lend themselves admirably to the program, because they can readily be selected for operation in the particular localities where they are required to provide employment to persons in need of relief; and second, there is an urgent need in all parts of this country for the improvement and extension of our highway system. The execution of the WPA road construction program is therefore a real contribution towards the material wealth of the United States, and the prosperity and happiness of its people.

The 1937 road construction program of the Works Progress Administration will be a continuation of the present program. Projects now in operation will be completed in their entirety if funds permit; otherwise the work will be so planned and executed that the stretches of highway on which work is done will be left in a completed condition. Many new road projects will be initiated, as requested by local work-relief needs, and carried through to completion. In the southern states, where mild weather conditions permit, actual road construction will be carried on throughout the 1937 program; in the northern states, it will, in some cases be necessary to suspend actual road construction work during the severe winter months, and to utilize this period for quarrying operations, to produce road foundation and surfacing materials to be later used on the projects.

No one who travels through any state or through any part of this country can fail to be impressed by the large number of WPA road construction projects already completed or under way, by the variety of the types of construction employed, and by the excellent quality of the completed work. Taken as a whole, the road construction program of the Works Progress Administration represents the largest program of its kind ever undertaken in the history of the United States, and accounts for well over a third of the entire WPA program.

Roads and highways are being drained, graded and resurfaced, and markets are being made accessible to farmers and other rural inhabitants through improvements to secondary roads, so as to make such roads usable at all seasons of the year. The constructing of these "farm-to-market" roads comprises about one third of all the WPA road work undertaken. It involves various types of improvements to the dirt roads of the country, including relocation, drainage, grading and such types of low-cost surfacing as will provide all-weather roads well adapted to meet the local needs. The WPA road program also includes the construction of all necessary drainage structures and bridges on the road projects. These vary all the way from the simplest type of metal culvert or stone masonry drainage structures, to the most modern type of reinforced concrete or steel truss or girder bridges.

(Continued on page 35)

• *Using a Haiss excavator, this street was graded preliminary to paving. The layer of clay loam to be removed varied from 8 inches to 2½ feet.*

EXCAVATING

FOUNDED 1905

A Monthly Publication

The Excavating Engineer Publishing Co.
South Milwaukee, Wisconsin

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The Business Situation

THE year just past has been the best for business in general since the depression hit us. And indications are that 1937 will see continued progress, though probably not a boom of the 1928 type.

In 1936 the major industries, led by automobiles, staged remarkable recoveries. Steel production followed the automotive and construction demand. While the latter field was still heavily fed by public funds, private construction has been climbing steadily. Railroad business has increased to a place where the industry is faced with a shortage of cars.

Gains in the heavy industry field were more than matched by increased business in consumer goods. It is important to note the usual end-of-the-year slackening in many industries did not occur in 1936. This is good indication that the demand built up during the lean years has scarcely begun to be fulfilled, and is bound to carry over into 1937.

Certain elements of unrest, like labor trouble and possible state and national legislation might normally tend to slow up business. But recoveries, like depressions, build up momentums which are hard to stop. Our present recovery is rolling along, and there is every reason to believe it will continue to do so in 1937.

The most important single factor in the business picture for 1937 and the future is governmental influence. There can be no question that our federal government is committed to maintaining continuous prosperity. It was this principle that was so overwhelmingly endorsed at the last election. The significant feature of this governmental necessity is, for 1937, that there must be no boom—because the inevitable aftermath of a boom is depression. For at least four more years we will be living under a system of managed economics. The government must strive for a gradual growth and expansion of business and industry; there must be no major spurts and no major set-backs.

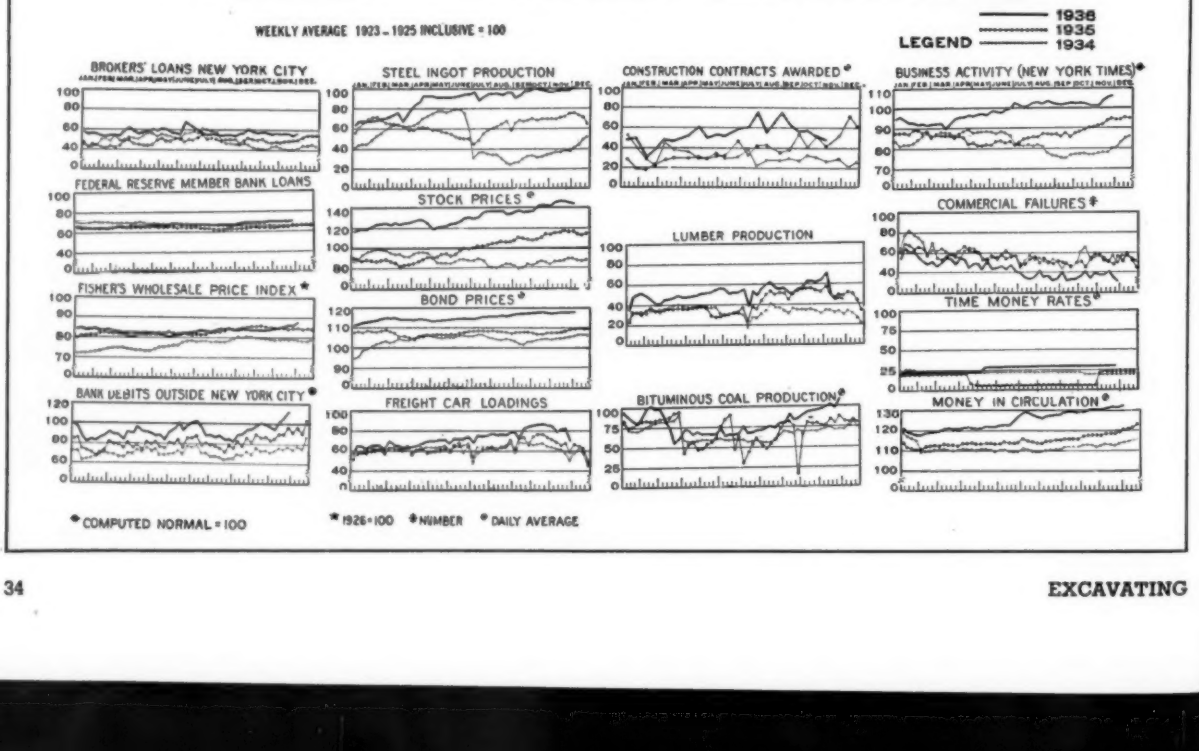
Just how this continuous progress will be achieved, and how successfully, it is impossible to predict. However, aided by the momentum of recovery, there is every probability that 1937 will see us continue to improve our economic situation.

Private Construction Again Exceeds Public

FOR the sixth time this year, the last three for consecutive months, the monthly volume of private construction has exceeded the total for public projects of every description. Reporting on construction in November, 1936, F. W. Dodge Corporation showed a total of $208,204,200 for the 37 eastern states covering both public and private jobs, as against $188,115,000, for November, 1935, and $225,767,900 for October of this year. Of the November, 1936, total about 58 per cent represented private projects, the remainder being public. For November, 1935 private construction accounted for less than 40 per cent of the total.

Residential building during November in the 37 eastern states amounted to $68,440,700 as against only $39,695,200 for November, 1935, and $79,664,700 for October this year. Non-residential building reported by the Dodge organization totaled $65,895,300 for November as against $68,080,300 for November of last year and $79,071,300 for October, 1936. Heavy engineering projects

WEEKLY BUSINESS INDICATORS


WEEKLY AVERAGE 1923 - 1925 INCLUSIVE = 100
LEGEND 1936 1935 1934
BROKERS' LOANS NEW YORK CITY
STEEL INGOT PRODUCTION
CONSTRUCTION CONTRACTS AWARDED *
BUSINESS ACTIVITY (NEW YORK TIMES) *
FEDERAL RESERVE MEMBER BANK LOANS
STOCK PRICES *
LUMBER PRODUCTION
COMMERCIAL FAILURES *
FISHER'S WHOLESALE PRICE INDEX *
BOND PRICES *
TIME MONEY RATES *
BANK DEBITS OUTSIDE NEW YORK CITY *
FREIGHT CAR LOADINGS
BITUMINOUS COAL PRODUCTION *
MONEY IN CIRCULATION *
* COMPUTED NORMAL = 100
* 1926 = 100 * NUMBER * DAILY AVERAGE

of every description undertaken in the 37 eastern states during November amounted to $73,868,200 as against $80,339,500 for November, 1935, and $67,032,400 for October, 1936.

The total volume of construction started in the 37 eastern states during the elapsed eleven months of 1936 amounted to $2,475,600,300 as compared with $1,580,408,400 for the corresponding eleven months of 1935. Of the 1936 cumulative total, $736,136,500 was for residential building; $880,303,700 for non-residential building; while the remainder went for heavy engineering projects. For residential building the improvement over 1935 now stands at 70 per cent while for non-residential building the gain is almost 60 per cent.

What's Ahead in Highway Work

AS REPORTED in the individual forecasts, about half the states expect decreases in highway funds for 1937. Eight states report anticipated increases — Iowa of 29 per cent, Rhode Island of 20, North Carolina and Illinois of 15, and Louisiana will have $29,600,991 available. The remaining states estimate little change in revenues from 1936.

At first sight, the picture thus presented might seem somewhat discouraging. Several factors contribute, however, to brightening the outlook. Last year's highway funds were the largest since 1931. With 43 state legislatures having regular sessions in 1937, it is difficult to estimate exact highway incomes. Hopeful factors are, however, the increasing sentiment against diversion, and the growing public concern over highway safety. If proponents of these worthy movements stir themselves, state legislatures may increase highway appropriations beyond present expectations.

The broad highway studies being conducted in 40 states will give those interested in highways scientific "ammunition" to convince those legislatures of the pressing need, and will enable highway financing to be put on a sound, long-term basis.

General business improvement is likely to result in considerably increased revenues from vehicle and gasoline taxes, which should up the funds available in the various states.

Despite these generally favorable factors, however, the forecasts for 1937 emphasize again the real necessity for cooperative effort to halt diversion.

Excavating again wishes to take advantage of this opportunity to thank the various state highway departments whose courtesy and special effort make possible the presentation of these annual highway forecasts.

EXCAVATING.
SO. MILWAUKEE. WIS.
OFFICIAL FIGURES COVERING APPORTIONMENT OF FEDERAL AID HIGHWAY FUNDS AUTHORIZED FOR FISCAL YEAR NINETEEN THIRTY EIGHT NOT YET AVAILABLE STOP APPORTIONMENT WILL BE MADE NOT LATER THAN JANUARY ONE NEXT-
MACDONALD BUREAU PUBLIC ROADS

"Look Ed, Pete's in Love Again".

Our Cover

FROM the West Coast, the South, the Midwest, and the East come the varied pictures of highway construction and maintenance on our cover. Excavating hauling, grading, and paving are all represented.

The pictures are presented through the courtesy of Allis-Chalmers Manufacturing Company, Bucyrus-Erie Company, Caterpillar Tractor Company, Chain Belt Company, Hercules Motor Company, International Harvester Company, and Jaeger Machine Company.

WPA Forecast

(*Continued from page 33*)

All WPA road construction projects are initiated and sponsored by the state, county, or other public administrative bodies entrusted with such work, and a portion of the cost is borne by the sponsors, who prepare the plans for the work, and provide such technical supervision as may be necessary. This cooperation is of great value in insuring that the most suitable types of construction are used, and that the work is so located as to be of value to the community. On many projects, the specifications of the state highway department are used for the work.

The money spent by the Works Progress Administration on roads was, and is, of course, incidental to the primary objective of providing employment to those in need of it; but the fact that the work thus done serves the double benefit of creating jobs and adding thousands of miles of improved highways to the rural road system is believed to be one of the most valuable features of the entire work-relief program.

EQUIPMENT

You Ought to Know About

Truck Driven Compressor

A TRUCK driven compressor, combined with a standard dump body has been announced by the Davey Compressor Co., Inc., Kent, Ohio, and is for use where intermittent rock drilling is involved.

By being mounted on a standard truck, the compressor can be easily transported to any job and the truck becomes available for any normal hauling purposes when not required for the driving of the air tools.

Pneumatic Tired Trailer

A NEW trailer, believed to be the largest capacity ever equipped with pneumatic tires, was recently delivered to a customer at Los Angeles, California, by Rogers Bros. Corporation, Albion, Pa.

The new trailer is of 30 ton capacity and is used in hauling shovels and other heavy equipment. It has an overall length of 47 feet 9 inches and the construction is entirely arc welded. The welding was done by the shielded arc process with equipment supplied by the Lincoln Electric Company, Cleveland, Ohio.

Streamlined Crawler Tractors

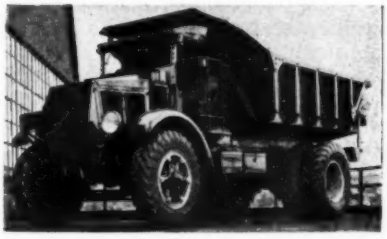
IN line with today's modern design methods comes the announcement of the streamlined Cletrac tractor. Elimination of sharp corners and projections and building in of a curved radiator grill and long narrow hood louvres are the salient features of the streamlining. Exhaust and intake are hidden from view. Comfort for the operator is provided in coil-spring-cushioned seat and adjustable foot rests and controls. Patented features such as controlled differential steering, one piece drop-forged shoe, track support, lubrication, design, and frame construction remain the same as before. Further information may be obtained by writing to The Cleveland Tractor Company at Cleveland, Ohio.

1937 Mack Truck Line

MACK Trucks Incorporated, 34th St. and 48th Ave., Long Island City, New York, announce for 1937, modern additions to their motor truck lines.

The Mack Traffic Type Dump Truck, models EC and EB, have streamlined cab with engine between seats, and doors opening ahead of the front fenders. The rear wheels are of the dual wheel type making for better traction and heavier loads carried. The truck is said to be easy to maneuver in and out of traffic and more adaptable to getting close to loading areas.

The model AC, four cylinder, heavy duty truck features an ex-



tension over the cab roof which is integral with the body; heavy armor plating on top of the hood, and crows nest arrangement on the left side of the driver's seat, so that the driver may leave the confines of his cab while backing up and by means of an auxiliary throttle, properly maneuver the truck.

The Mack Jr. model 10 M dump truck is a six cylinder job, with four speed transmission, and with single reduction axle. The 10 M is one of four in the Junior line which includes the 1 M, 10 M, 20 M, and 30 M, ranging in gross weight capacity from 4,500 pounds to 15,500 pounds. Prices start at $535.00.

Low Cost Oxygen for Welding

THE Lincoln Electric Company, Cleveland, Ohio, has announced completion of negotiations whereby it will represent the Messer Company of Frankfort on Main, Germany, in the United States.

The Messer Company is designer and patentee of a low-priced automatic oxygen machine with which users of oxygen for cutting and acetylene welding can produce oxygen in their own plants at a cost much lower than heretofore possible. Plants using as low as 500 cubic feet of oxygen

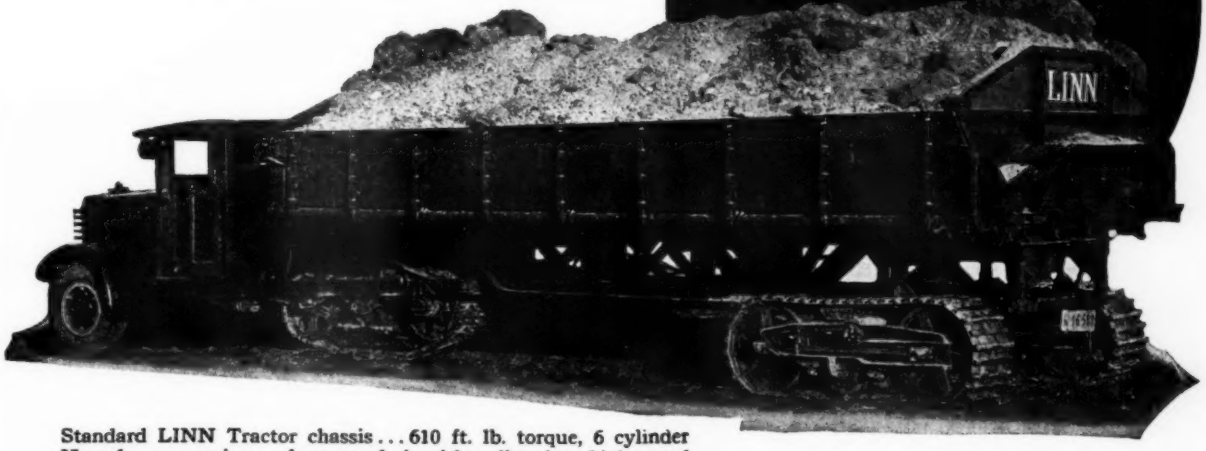
They're Here!

2 NEW ADDITIONS TO THE LINN LINE

THE 12-15 YARD LINN TRACTOR (SERIES L)

Equipped with 610 ft. lb. torque, 6 cylinder Hercules gasoline engine... four speeds in either direction, high speed 8 M.P.H.... wide, long, low-loading bodies... end dump bodies furnished with automatic down-fold tail gate and heavy-duty underbody hoists... dumping angle 50°... larger track area. Also furnished with 2 way side tipping bodies, with dumping angle of 50°... platform bodies... and logging bunks. (Diesel motor optional).

THE 25-30 YARD LINN TRACTOR TRAILER (SERIES T)



Standard LINN Tractor chassis... 610 ft. lb. torque, 6 cylinder Hercules gas engine... four speeds in either direction, high speed 8 M.P.H. Semi-trailer body illustrated is two-way dumping with heavy-duty underbody hoists and automatic down-fold side gates. Dumping angle 50°. Also furnished with platform and stake bodies for general hauling... and logging bunks for hauling long length logs. (Diesel motor optional).

LINN TRACTORS

LINN Products Are Patented

WRITE FOR COMPLETE DETAILS

THE LINN MANUFACTURING CORPORATION

MORRIS, NEW YORK

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Baltimore, Md. · Boston, Mass. · Dallas, Texas · Denver, Col. · East Orange, N. J. · Fairport, N. Y. · Glens Falls, N. Y. · Greenwood, Miss. · Huntington, W. Va. · Knoxville, Tenn. · Los Angeles, Cal. · New Haven, Conn. · New York, N. Y. · Paducah, Ky. · Pittsburgh, Pa. · Port Carbon, Pa. · Portland, Ore. · Providence, R. I. · Roanoke, Virginia · St. Louis, Mo. · St. Paul, Minn. · Sioux Fall, S. D. · Skowhegan, Maine · Spokane, Wash. · Worcester, Mass.

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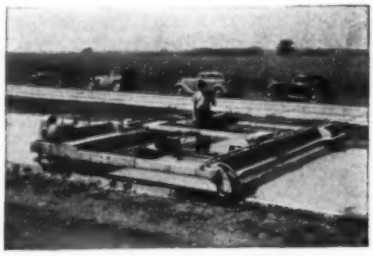
NEWFOUNDLAND, AND NEWFOUNDLAND LABRADOR
Dominion Distributors Company, Mitchell Building, St. John's

For your convenience in writing The Linn Manufacturing Corporation, you will find a card bound in this issue.

per day can use this machine economically, according to the Lincoln Company. A demonstration plant near Cleveland is planned.

Longitudinal Finisher

THE Koehring Company of Milwaukee, Wisconsin is now manufacturing a Longitudinal Finisher for the finishing of the



slab of concrete highways. The work is accomplished by the longitudinal back and forth movement of a screed travelling forward as it crosses the slab from form to form. The screed conforms exactly to crown, by means of an adjustable template track for the travel of rollers attached to the screed carriage. High spots are planed and low spots are filled by a kneading action, without disturbing the texture of the concrete. A very slight angle to the screed assures the movement of excess concrete forward and away from the finished section.

Thor Clay Diggers

THE Independent Pneumatic Tool Company announced this month their No. 401 and No. 402 Clay Diggers.

The outstanding feature of these tools is the new Thor Pigtail Rubber Bumper. This spiral bumper fits around the shank of the spade as well as inside the retainer, thus forming a packing that prevents dirt or gravel from entering.

In these two models, the lock collar has been entirely abandoned, the handle and barrel being clamped together with two bolts. A modern type retainer is used, with a lock, that is not affected by dirt or gravel.

The Thor No. 401 Clay Digger is especially adapted for tunnel work, being light, powerful, and capable of standing the rough usage to which tools of this nature are subjected.

The Thor No. 402 Clay Digger can be used in caissons and large tunnels where the ground is especially hard. With a chisel point it can be used for light demolition work.

Both of these Clay Diggers with ball end butts can be used for vibrating concrete in forms by tamping the wood or steel forms.

New 5/8-yard Excavator Announced

THE Bucyrus-Erie Co., South Milwaukee, Wis., has added a companion machine to its 10-B, 3/8-yard shovel. It is the 19-B 5/8-yard excavator. This machine weighs but 16 tons, travels at a speed of 1¾ M.P.H., has a swing speed of 4¾ R.P.M., and a hoist line speed of 184 F.P.M.

Like the 10-B, the 19-B with narrow overall width and short tail swing permits normal operation in tight quarters, in traffic, in narrow alleys, or close to a wall or bank.

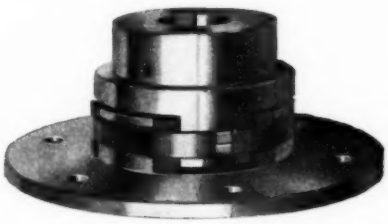
Seven types of front end are available making it possible to convert this machine from shovel to dragline, clamshell, lifting

crane, drag shovel, skimmer, or backfiller. The cab is fully air conditioned and streamlined providing complete visibility and ventilation for the operator. The doors open on both sides offering quick accessibility to the main machinery.

An elaborately prepared and illustrated bulletin describing the new 19-B machine is available by writing to the Bucyrus-Erie Company, Publicity Department, South Milwaukee, Wis.

L-R Flexible Couplings

LOVEJOY Tool Works, 4962 West Lake Street, Chicago, announce an L-R coupling of new design in the Type WF, which is



made with one of the bodies in the form of a flange, bolting onto the flywheel or a clutch or brake drum of a Diesel, gas or steam engine.

The flange-body design reduces the overall length of this coupling by one-third. The WFR-800 coupling, capable of carrying a load of 324,000 inch pounds, extends less than 6 inches beyond the rim of the flywheel, allowing more room for frame and other parts.

The L-R Type WF Flexible Coupling will be made in sizes from 14″ to 30″ bores suitable for 2500 H.P. at 100 R.P.M. Free floating load cushions are held in place by a quickly removable outside retaining spring. This permits larger hubs and greater load carrying surfaces with increased

(Continued on page 68)

AMERICAN TIGER BRAND IS USED TO *rough going*

AMERICAN TIGER BRAND WIRE ROPE

WHEREVER the going is tough —and the need for exceptional dependability exists — American Tiger Brand Wire Rope will establish remarkable records for its users.

This wire rope has proved its worth in keeping equipment in operation, in doing away with costly replacements and in lowering operating costs. Experience has proved its superiority. Always specify American Tiger Brand Wire Rope. Convenient stocks and our nearby engineers are both at your immediate call.

American Tiger Brand Wire Rope
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Amerclad All-Rubber Cables
Electrical Wires and Cables
Tiger Wire Rope Clips
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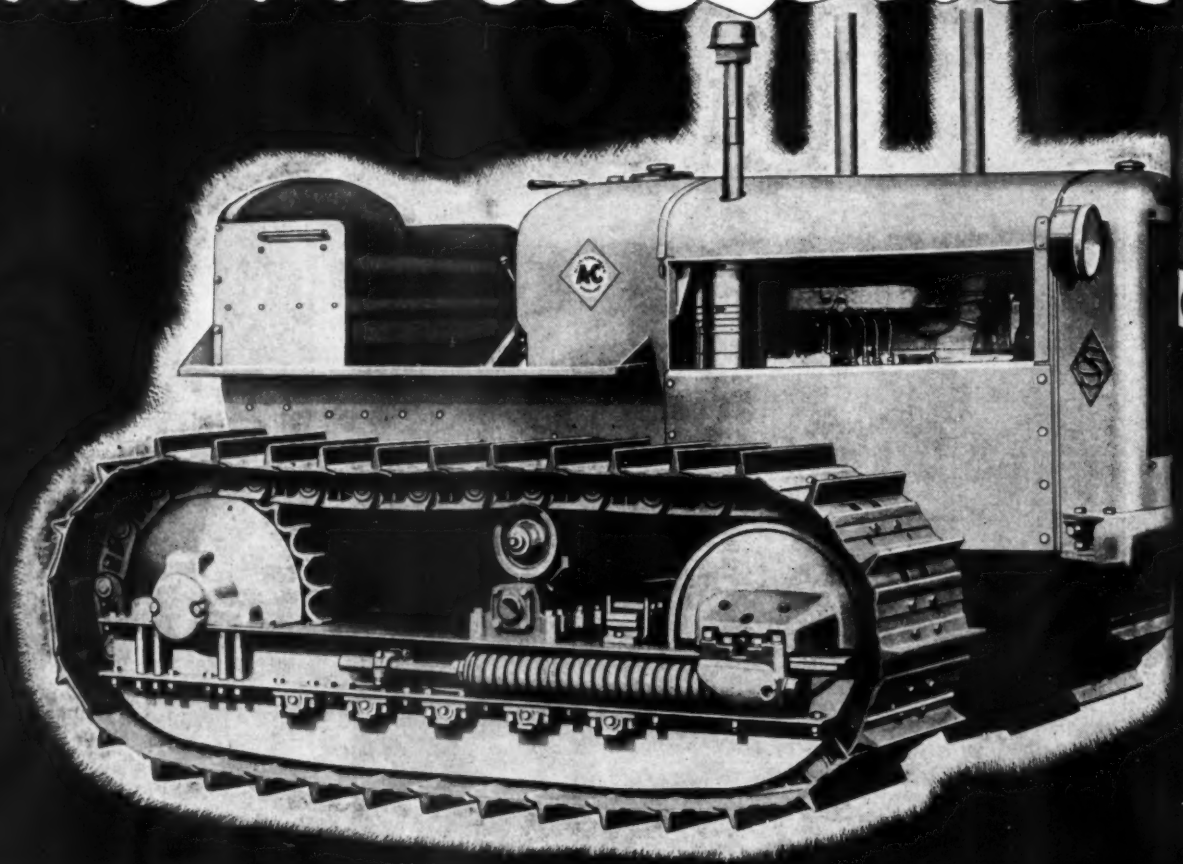
UNITED STATES STEEL

For your convenience in writing to United States Steel Corporation Subisidiaries, you will find a card bound in this issue.

The New Leade



- CONTROLLED IGNITION
- FIVE SPEEDS FORWARD; ONE REVERSE
- DIESEL FUEL OIL ECONOMY
- CONSTANT MESH TRANSMISSION
- TRUCK-TYPE GEAR SHIFT
- ROLLER BEARING TRACKS
- CONTROLLED TRACK ALIGNMENT
- MORE POWER PER POUND
- INSTANT STARTING
- UP TO 6.37 MILES AN HOUR

PULLS 10-YARD TRACK WAGON

...IN ITS POWER CLASS

MODEL "S-O"

ONTROLLED IGNITION OIL TRACTOR

TO MEET THE NEED for a fast, flexible tractor in this particular power class . . . Allis-Chalmers presents the sturdy, fast-stepping Model "S-O." An entirely new tractor—new engine, new transmission, new tracks—all designed to work together; all built to fit the job. Handles 7 to 8-yard scrapers, 12-foot blade grader or 10-yard track wagon. New Constant-Mesh Transmission—you shift gears with the tractor in motion. Five speeds forward—up to 6.37 miles an hour. Operates on low cost Diesel fuel oil—with the exclusive A-C advantage of Controlled Ignition—one of the greatest tractor improvements in years. The "S-O" brings a new kind of tractor performance to its size and price class.

AGON OR 12-FOOT ALLIS-CHALMERS BLADE GRADER

HANDLES 7 TO 8-YARD SCRAPERS

LLIS-CHALMERS
TRACTOR DIVISION—MILWAUKEE, U. S. A.

Controlled Ignition OIL TRACTORS

SHOTS *from the Firing Line*

Road Builders Expect Banner Convention

THE annual convention of the American Road Builders Association, being held in New Orleans, January 11 to 15, promises to be of unusual interest. The program, covering all the major subjects relating to continuation of the most effective highway program, is the most comprehensive of the Association's history.

Two of the most significant program features will be the report of the Committee on Safe Highways, headed by H. E. Tabler of Maryland, and that of the Committee on Gasoline Tax Diversion, headed by Murray D. Van Wagoner of Michigan.

One hundred and twenty-five manufacturers of highway equipment and materials will display the latest developments in the field in two floors of the New Orleans municipal auditorium. The exhibit is being arranged to facilitate inspection and study.

Many of the delegates are arranging to take advantage of the Mexican government's invitation to inspect portions of the Pan-American Highway between Mexico City and Laredo, Texas. Three post-convention tours of 15 days each, including visits to Vera Cruz, Mexico City, Havana, and Miami, have been arranged by the Association.

To Study Highway Accidents

CAUSES of highway accidents and conditions contributing to them, are to be thoroughly studied by the Bureau of Public Roads of the U. S. Department of Agriculture and the Highway Research Board of the National Research Council. These organizations have announced an agreement for a joint study of the subject from several angles in which the services of nationally known traffic specialists and psychologists will be enlisted. The Bureau of Public Roads is initiating this work under the act of Congress of last June authorizing expenditure of $75,000 in investigating traffic conditions and requiring that recommendations for corrective legislation be made.

As a basis for effective action to correct conditions, a report will be made on the wide divergence in State and municipal traffic laws.

Particular attention is to be given to the driver with a record of several accidents. It is definitely known from experience in safety work and from studies of drivers in industrial fleets that certain drivers are prone to be involved in accidents. Often it is impossible to show that such a person is responsible for the accident but for some reason he has the unhappy faculty of being involved in accidents. It is not known how many drivers are in the high-accident class, the extent to which they may be classed as reckless drivers or the standards to be applied in identifying them.

Several studies are planned to throw more light on the driver's responsibility for accidents as a basis for suggesting corrective measures. A careful study of all existing reports and statistical data will first be made so that significant factors will not be overlooked and so that duplication of work will be avoided. A statistical study is to be made of the accident records of a large number of drivers, covering a considerable number of years. This study will be confined to states and cities where adequate records have been kept.

Other cooperating organizations, in addition to those represented on the Advisory Committee, include the Department of Motor Vehicles of the State of Connecticut, the Michigan State Police, and the American Association of Motor Vehicle Administrators.

• *Flettons, Ltd. of England are using this Ruston-Bucyrus electric dragline for excavating clay. With a 70-foot boom and a 1½-yard bucket, the machine was operating at an actual vertical working depth of 81 feet when the photograph was taken. Can anybody tell us of a similar machine with 70-foot boom which has worked a greater depth?*

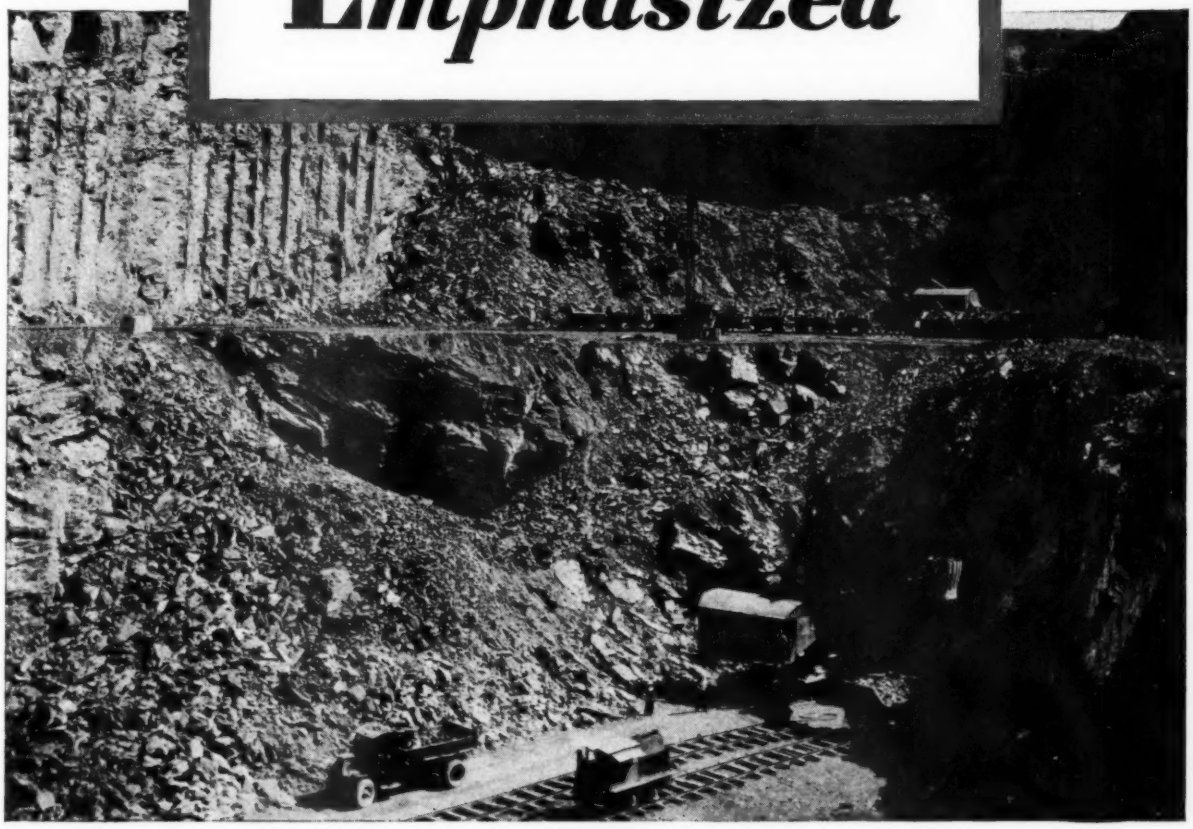
A. E. D. Meeting

THE annual meeting of the Associated Equipment Distributors is being held January 10, 11 and 12, with headquarters at the Roosevelt Hotel in New Orleans. These dates coincide with the meeting of the American Road Builders Association.

A very interesting program has been prepared by G. F. Lowe, Chicago, Ill., chairman of the program committee. The second day of the session has been designated "manufacturer day" and problems concerning both the distributor and the manufacturer will be discussed. The other two days will be de-

• *Building up a road fill at Doe Gully, West Virginia. The tracks are those of the Baltimore & Ohio Railroad; the machines, Kochring Dumptors.*

WHERE *Efficiency* IS *Emphasized*



AS indicated in the accompanying illustration, the Lehigh Portland Cement Company's workings at Sandts Eddy, Pa., is an excellent example of efficient large scale production. Here smooth operation with minimum waste energy is a primary consideration.

Naturally Cordeau-Bickford Detonating Fuse is used. Users of Cordeau recognize that true efficiency starts with the blast. Each charge must result in proper fragmentation, easier removal.

Consider Cordeau and its other advantages: more work from explosives through direct detonation of each cartridge which goes with the force of a primer cartridge; and charges fired in split second rotation for relief of burden. Here is perfect teamwork where teamwork counts.

Let us send you, free, a copy of the Cordeau book.

CB59

CORDEAU-BICKFORD DETONATING FUSE

THE ENSIGN-BICKFORD COMPANY, SIMSBURY, CONN.

MAKERS OF ENSIGN-BICKFORD SAFETY FUSE SINCE 1836

For your convenience in writing to The Ensign-Bickford Company, you will find a card bound in this issue.

• *The gates in immediate foreground are open to start diverting the Columbia through the west bank area. The water thus diverted so far is a small portion of the river but it thundered through the gates with plenty of roar.*

voted to intimate distributor matters and, in view of the many important problems confronting business, it is conceded that this period will be of vital interest to every member.

This is the first time that the A. E. D. has met in the South. Southern members this year have been insistent that the Association follow the American Road Builders Congress to Dixieland. This idea met with a very favorable response on the part of many Northern members who look forward to basking in the warmer climate of New Orleans in contrast to that of the Great Lakes region.

The session will be presided over by J. S. Gilman of Minneapolis, president, assisted by G. F. Lowe of Chicago, first vice-president. A. C. Blaisdell of Cincinnati is secretary and treasurer.

First Cross-Stream Cofferdam at Grand Coulee

SUCCESSFUL closure of a temporary cofferdam directly across the channel at Grand Coulee Dam has been effected. It is expected that closure of the second, upstream, cofferdam will follow shortly. Completion of this step is called, by F. A. Banks, Bureau of Reclamation construction engineer, the most difficult engineering feat yet encountered on this dam.

The diverted Columbia will flow through gaps left for the purpose in the concrete stricture of the west bank area. Four of these slots will handle regular flow, and others, built up higher, will take care of flood flow.

The ingenious frozen dam, which halted slides, enabled the excavation for the east bank area to be completed on schedule.

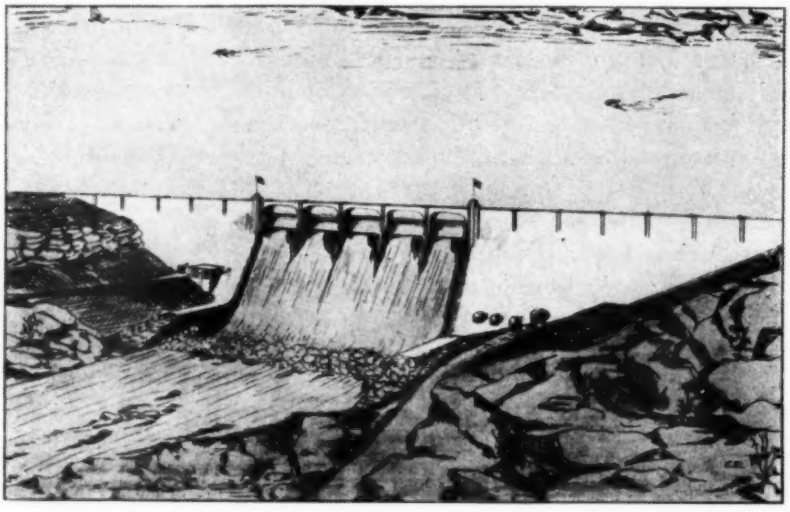
Contract for 20 sets of gates for the first tier of the outlet works has been awarded to the Hardie-Tynes Manufacturing Company of Birmingham, Alabama, on its bid of $1,454,141.21.

Conchas Dam Award

BENT BROTHERS, Inc., and the Griffith Company, both of Los Angeles, have been awarded the contract for construction of Conchas Dam on the South Canadian River, near Tucumcare, New Mexico, according to announcement by U. S. Engineers. The successful bid amounted to $4,587,676.

The dam will be a concrete gravity structure, approximately 220 feet high and 1250 feet long. Earth dikes on each side of the main structure will stretch total width to about four miles. About 650,000 yards of concrete will go into the main dam, and 3,500,000 yards of fill material into the dikes. An overfill spillway 300 feet long will be constructed in the main dam, and a 3000-foot emergency spillway in the north dike will take care of large floods.

Conchas dam is being built for flood control, irrigation and municipal water supply benefits. It will create a reservoir with a storage capacity of 600,000 acre-feet, extending about 14 miles up the South Canadian River Valley and nine miles up the Conchas River Valley.



• *Artist's drawing showing finished appearance of Conchas Dam and reservoir.*

Highway Lighting Progress

WITH the general public becoming more and more conscious of the accident situation on our highways, and with statistics showing that the major portion of fatal accidents occur at night, highway lighting received considerable interest in 1936.

A complete and powerful installation of sodium lighting units on the new San Francisco-Oakland Bay bridge is expediting the flow of night traffic, minimizing the hazards of driving in dusk, darkness and fog.

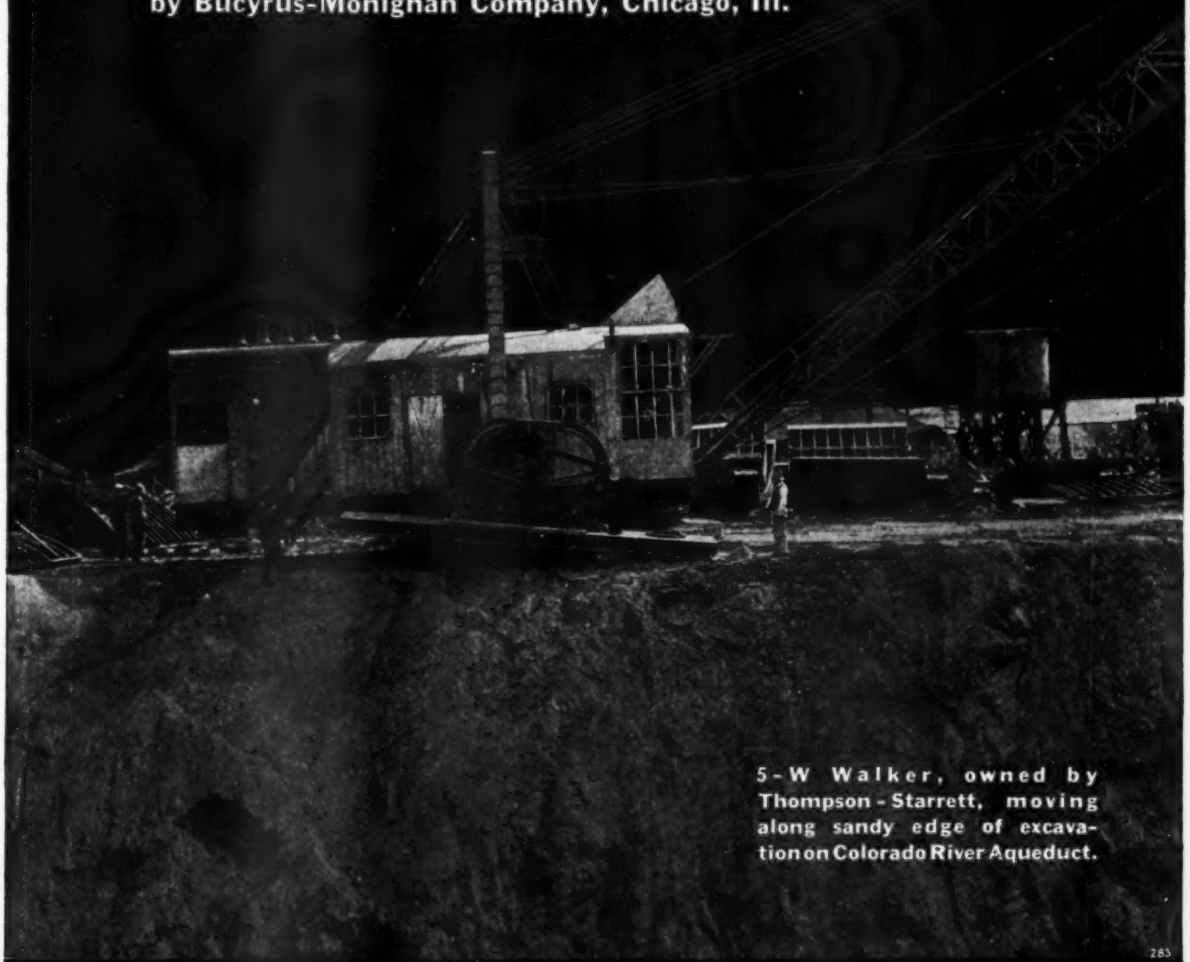
The longest stretch of safety lighting is a section, over 17 miles long, on Route 7 outside of Schenectady, New York. 391 units, equipped with 10,000-lumen sodium lamps, are spaced 230 feet apart along the highway, at a mounting height of 25 feet.

Another landmark of 1936 was the program, initiated late in July by the Ohio State Safety Council, for the establishment of 48 safety lighting demonstrations along one mile stretches of dangerous routes. Three of these units are already in operation, and the others will follow soon.

In all, some 31 states have taken ac-

BUCYRUS-MONIGHAN

welcomes work in restricted areas. When the spoil bank gets so close to the edge of the excavation that any other type dragline would have difficulty in moving . . . except parallel to the excavation . . . that's where the Walker proves its mettle. The operator touches the controls . . . and the Walker steps away sharply at any angle and without maneuver. Manufactured by Bucyrus-Monighan Company, Chicago, Ill.



5-W Walker, owned by Thompson-Starrett, moving along sandy edge of excavation on Colorado River Aqueduct.

283

BUCYRUS MONIGHAN

Sold by BUCYRUS-ERIE CO.
SOUTH MILWAUKEE, WISCONSIN, U.S.A.

For your convenience in writing to Bucyrus-Erie, you will find a card bound in this issue.

• *In Warren County, Tennessee, this Austin-Western 9x16 crushing plant is furnishing gravel for road work.*

tion in highway lighting for safety. Power companies have cooperated in demonstrational programs, and all indications are for a continued growth of and interest in highway safety lighting.

Fresno Dam Awarded

WACHTER-O'NEILL Construction Company and McGarry Brothers of Bismarck, North Dakota, have been awarded contract for construction of Fresno Dam on the Milk River Federal Reclamation project on their joint bid of $980,804.

The successful bid was the lowest of eight received October 30 by the Bureau of Reclamation at its office at Malta, Montana. Work must be completed in 1,100 calendar days of receipt of notice to proceed.

Actual award of the contract will be delayed until repayment contracts have been completed with water users. The repayment contracts are expected to be completed shortly.

Fresno Dam will be constructed in the Milk River about 2½ miles north of Fresno, Montana. It will be 80 feet high and will have a crest length of 2,100 feet. It will form a reservoir of a capacity of 243,575 acre-feet to provide a supplemental water supply for project lands.

The principal features involved in construction of Fresno Dam will be a concrete-lined tunnel through which the river will be diverted during construction and in which the outlet works, consisting of two 72-inch plate-steel pipes will be installed when construction is complete; a concrete-lined, open-channel spillway in the left abutment of the dam; and the dam itself. The dam will consist of a moistened and rolled embankment of clay, sand and gravel, with a three-foot layer of rock riprap above the berm on the upstream face, and a heavy rock fill at the downstream toe. The spillway will be uncontrolled and will end in a concrete-lined stilling basin.

Tennessee-WPA Road Program

By Burr Cullom

THE Tennessee Highway Department, as Supervisor, and the various participating counties of the state as sponsors have taken full advantage of the labor provided by WPA.

Figures recently released by the State Highway Department disclose that during the first year of the program, ending with September 1936, 16,254 miles of farm-to-market roads were widened and reshaped. During the same period 6,043 bridges were built. All of these were of timber except 66 of steel and 5 of concrete.

For the same period 17,034 miles of roads were ditched and dressed. The report showed 160,718 cubic yards of common excavation, 2,124,212 cubic yards of unclassified excavation. This work was done largely by hand labor, though graders, slip scoops, trucks and much other road equipment were used where available. Surfacing was largely with crushed stone and gravel, 2,687,755 cubic yards being used. Scores of quarries and gravel beds supplied the material.

Col. Harry S. Berry, State WPA Administrator, places road work at the head of his program. Colonel Berry formerly headed the Tennessee Highway Department. During his incumbency, the roads of the state advanced to the forefront of southern systems.

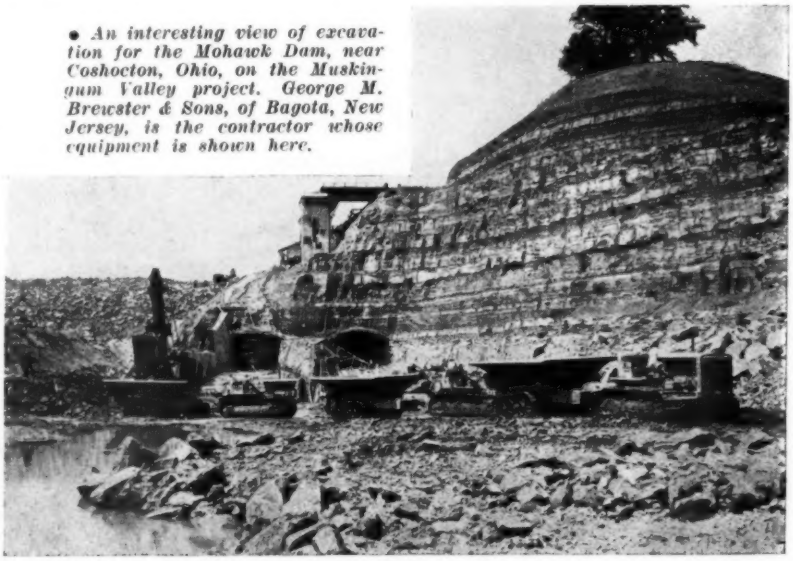
Marshall Ford Dam Award

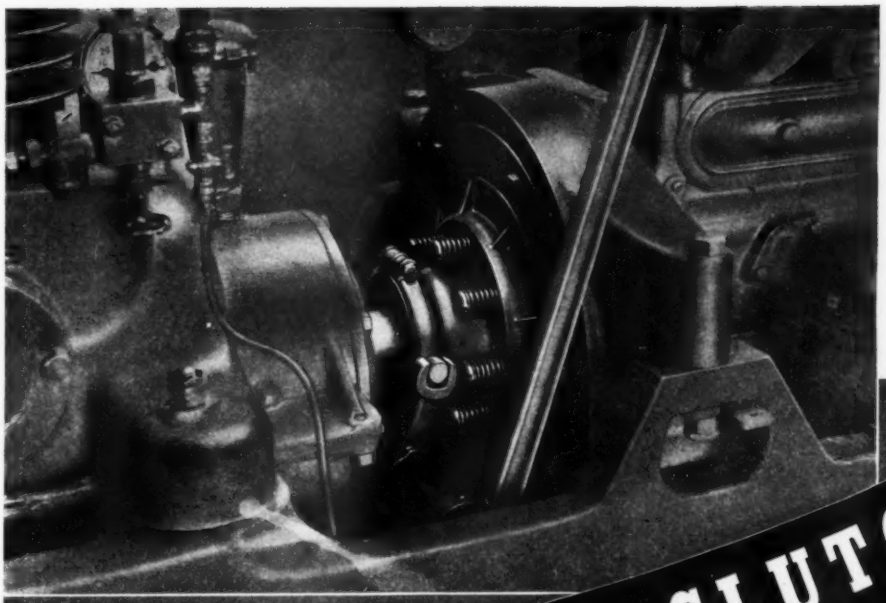
BROWN and Root, Inc., of Austin, and McKenzie Construction Company, of San Antonio, have been awarded contract for construction of Marshall Ford Dam on their joint bid of $5,781,235.

Marshall Ford Dam will be constructed in two stages. The ultimate dam will be 265 feet high. The present contract calls for construction of the first stage, a dam 190 feet high, which later may be raised.

The dam is designed to provide control of the floods of the erratic and dangerous Colorado River of Texas. It will be one of a series of power and flood control dams on the river above Austin, the others to be constructed by the Lower Colorado River Authority, an agency created under Texas law. Mar-

• *An interesting view of excavation for the Mohawk Dam, near Coshocton, Ohio, on the Muskingum Valley project. George M. Brewster & Sons, of Bagota, New Jersey, is the contractor whose equipment is shown here.*





Twin Disc multiple disc, spring loaded clutch insures easier starting for the Chicago Pneumatic Tool Company's Two-Stage, Air-Cooled Portable Compressors.

A COMPACT CLUTCH *that needs no adjustment*

● **The Chicago Pneumatic Tool Company equip their Two-Stage Air-Cooled Portable Compressors with the Twin Disc Spring Loaded Type Clutch because it is spring loaded and is compact—two prime requisites in portable compressor service. Its use simplifies operation in that it permits starting the engine with the compressor disengaged, which makes for easier starting, particularly in cold weather.**

Self-adjusting and trouble-free, this compact spring loaded, multiple disc, dry plate clutch was especially developed by Twin Disc for air compressors, pumps, etc.

When clutch is engaged, the tension of the springs holds the special moulded, non-burning asbestos discs against the driving member and automatically loads up the clutch, assuring a positive drive. It is made flexible to compensate for axial and radial misalignment.

What is *your* clutch problem? Write to the Twin Disc engineers for specific recommendations. Engineering data on request.

TWIN DISC CLUTCHES

TWIN DISC CLUTCH COMPANY

1335 RACINE STREET RACINE, WISCONSIN

For your convenience in writing to Twin Disc Clutch Co., you will find a card bound in this issue.

• During the floods of last spring, the Mad River lived up to its name and ripped out a section of road bed in Waterville, New Hampshire. Hagan-Thilodeau Construction Company used this Bucyrus-Erie steamer to clean up, build a rock barricade between road and river, and relocate the latter for a distance of 3,500 feet.

shall Ford Dam will be constructed by the Bureau of Reclamation.

The low dam at Marshall Ford, about 18 miles above Austin, will be a concrete dam of the straight-gravity type. It will have a crest of about 2,325 feet. An embankment 30 feet high and 1,100 feet long will be constructed, as a part of this contract, at the left abutment. The dam will create a reservoir with a capacity of about 600,000 acre-feet. The ultimate high dam will increase the capacity of this reservoir to about 3,000,000 acre-feet and will permit generation of about 60,000 kilowatts of electric energy.

No power plant will be constructed at this time, although the penstocks will be included in the low dam. These will be capped for the present.

The outlet works to be installed for operation in the low dam will consist of 24 tunnels 8 feet, 6 inches in diameter and controlled by paradox gates 102 inches in diameter. The spillway, 730 feet long, will be in the central section of the dam. During periods of flood flow the river may overtop the dam in the spillway section.

Diesel Anniversary

THE fortieth anniversary of the introduction of Diesel power was celebrated by two meetings last month. On December 2, a luncheon meeting of 300 business, industrial and engineering leaders, arranged by the Diesel Committee of the Exposition of Power and Mechanical Engineering, celebrated the anniversary. Chairman of the Diesel Committee was Gordon Rentschler, president of the National City Bank of New York.

In Chicago on December 7, a similar meeting paid honor to the memory of Dr. Rudolf Diesel, the inventor of the Diesel engine. Host for this meeting was B. C. Heacock, president of the Caterpillar Tractor Company. Principal speaker was John B. Kennedy, radio news commentator, who told of a recent 10,000-mile air trip during which he visited all the leading Diesel manufacturing plants in the country. Mr. Kennedy also outlined the brilliant progress made in the application of Diesel power in the last few years.

"DXL" DRAGLINE BUCKET

your key to bigger payloads

Special alloy steel enables a lighter yet stronger construction. The result — freer handling and a saving of crane power. *Write for bulletin.*

THE WELLMAN ENGINEERING CO.
7002 Central Ave., Cleveland, Ohio

WILLIAMS BUCKETS

Road Bureau Work in 1936

ABOUT 13,790 miles of roads and streets were completed during the fiscal year ending June 30, 1936, under the cooperative work of state and federal agencies, according to the report just issued by Secretary Wallace of the Department of Agriculture. A large part of the road construction activity of the department centers in the administration of funds granted the states for unemployment relief through highway and grade crossing construction.

Of the above total 7,355 miles were on the federal-aid highway system outside of cities, 755 miles on city extensions of the federal-aid system, and 5,679 miles on feeder and secondary roads. In addition to this work, the department also completed improvements on 22 miles of flood damaged roads, 236 miles of forest highways, 436 miles through other public lands, 5,684 miles of forest roads, and 1,965 miles of forest trails.

At the end of the year the department's program involved a total of 25,812 miles of all classes of road construction.

The federal Bureau of Public Roads attacked grade crossing elimination on a large scale during the last fiscal year. Three hundred grade crossings were eliminated, either by building of structures or by relocation of highways; 10 existing structures were rebuilt; and protective devices were installed at 185 crossings.

In addition, the department had under contract or approved 1,466 grade crossing eliminations and 813 crossing protection projects which will be completed by the end of the year.

Nearly 7,000 grade crossings have been eliminated with the assistance of the federal government since 1916, and a total of about 2,000 are to be eliminated under the present $200,000,000 program.

Honor Traffic Line Originator

THE man who originated the center traffic line now in universal use for marking highways was honored for this contribution to motoring safety at the annual banquet climaxing the 34th an-

For your convenience in writing to Wellman Engineering Co., you will find a card bound in this issue.

• 850,000 yards were moved on Ohio's Muskingham Valley project with the fleet of equipment of which this Caterpillar elevating grader and G.M. truck equipped with Grico Two-Axle drive were part.

nual meeting of the American Automobile Association in Detroit recently.

Edward N. Hines, road commissioner for Wayne County, was presented with a plaque commemorating his contribution by J. D. Tew, president of the B. F. Goodrich Company, which some time ago launched a search throughout the country for the originator of the center traffic line idea.

Alamogordo Dam Plans Altered

A CHANGE in the plan for the Alamogordo Dam of the Carlsbad Federal Reclamation project, to increase its height by seven feet to 142 feet, has been approved.

This dam, now under construction on the Pecos River near Fort Sumner, New Mexico, will supplement the old McMillan Reservoir, which is leaky and inadequate, in the irrigation water supply system of the project.

The increased height of Alamogordo Dam, an earth and rockfill structure, will provide a reservoir capacity of 157,000 acre-feet, an increase of 43,000 acre-feet over the original plan.

The Hollett Construction Company of Crosby, Minnesota, is constructing the dam under a contract with the Bureau of Reclamation. The original contract called for payment to the contractor of $1,132,547 for completion of the dam. Under the change order the net increase in the amount under the contract will be $175,188.10.

The increase in the capacity of the Alamogordo Reservoir will double the length of time which will pass before silting will begin to interfere with storage needed each year by the irrigators, extending this period, according to conservative estimates, to more than 45 years.

The change in plans contemplates installation of three radial gates in the spillway. These gates will not be installed, however, for perhaps 20 or 25 years, pending the time when silting makes necessary the additional capacity which can be gained in this fashion. The original plan called for installation of spillway gates at this time. Postponement of the installation of the spillway gates will reduce the annual operation and maintenance cost of the dam.

HAYWARD BUCKETS

WON'T QUIT
OR CAUSE TIME OUT

A Hayward Bucket keeps the job going ahead on scheduled time. It won't quit or cause time out.

THE HAYWARD COMPANY
52-54 Church Street
New York, N. Y.

Here Is a Bargain
in used excavating equipment

(taken from page 77)

BUCYRUS-ERIE 48-B DIESEL SHOVEL. 23' boom—18'-3" dipper handle—2 cu. yd. bowl door dipper. Chain crowd. Single shaft cat. Electric starter. Buda Diesel 6 cylinder 6½" x8¾" engine. Factory rebuilt. New machine guarantee. Available February 1. Located Indiana. Box 938-SS.

For other bargains in shovels, draglines, cranes, locomotives, trenchers, and miscellaneous contractors' equipment turn to pages 76 to 79.

The largest listing of Used Equipment offered by any Publication Serving the Excavating Industry.

Do you know the answers?

What type of machine is most satisfactory for moving dirt from a wide borrow pit into a solid embankment or fill?

What is the cheapest way of handling gravel from the bed of a river to a screening plant on shore?

How would you set up a drag scraper to pile a maximum tonnage of crushed stone, ore or other bulk materials on a specified ground space and to assure easy and rapid reclaiming?

Questions like the above and hundreds of others are answered in the new Catalog No. 18.

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SAUERMAN BROS., Inc.
474 S. CLINTON STREET, CHICAGO

For your convenience in writing to the advertisers on this page, you will find a card bound in this issue.

1937 Highway Forecast

(Continued from Page 25)

Montana

A sharp curtailment of highway work in Montana is anticipated for 1937 because of a 40 per cent decrease in available funds, according to information received from the State Highway Commission.

Construction work amounting to $6,000,000 and maintenance amounting to $2,000,000 is planned. The sources of revenue are: Federal Aid, $3,500,000; and state gas tax, $4,500,000.

Detailed information as to the types of work to be carried on is not available at the present time. In 1936 no highway funds were diverted.

Nebraska

On the present taxation basis, Nebraska will have $8,841,033 available for highway work during 1937. Construction will require $5,541,033; maintenance, $3,000,000; and office salaries and expenses, $300,000. This is a decrease of 38 per cent from 1936 obligations.

Until steps are taken to increase revenues, Nebraska will be unable to meet Federal Aid balances. Thus only the sum of $2,965,081 will be available out of the following Federal sources: ½ Federal grade crossing, fiscal year 1937-38, $444,555; ½ Federal Aid, fiscal year 1937-38, $1,551,300; balance of the National recovery highway program (1935), $30,047; balance of Federal Aid, fiscal year 1935-36, $61,269; balance of Federal Aid, 1936-37, $2,391,413; balance of Emergency Flood Relief fund, $69,130; balance of Works Progress highway funds, $266,631; balance of Works Progress grade crossing funds, $111,156. Of the total state gas tax of $5,611,452 and vehicle license fees of $600,000, but $5,875,952 can be applied.

Although there was no diversion of funds in 1936, an additional one cent per gallon gas tax went to state relief.

• *This extremely interesting view of concrete surfacing shows a Rex 27E Paver at work on Sherman Boulevard in Chicago.*

Elimination of railroad grade crossing hazards at an unprecedented rate has been made possible by the allocation in 1935 of $200,000,000 of emergency relief funds for the purpose, according to the Bureau of Public Roads. With these funds alone, 2,097 existing grade crossings will be eliminated, 320 old grade-separating bridges will be rebuilt, and 1,037 crossings will be protected by the installation of safety gates, flashing signals, or other warning and safety devices.

Of the 2,097 grade crossings to be eliminated, 1,579 will be wiped out by the construction of bridges to carry the highways under or over railroads; the remaining 518 will be avoided by relocation of the highways.

Detailed information is not available at this date as to the division of 1937 construction funds and the work that will be carried over from 1936.

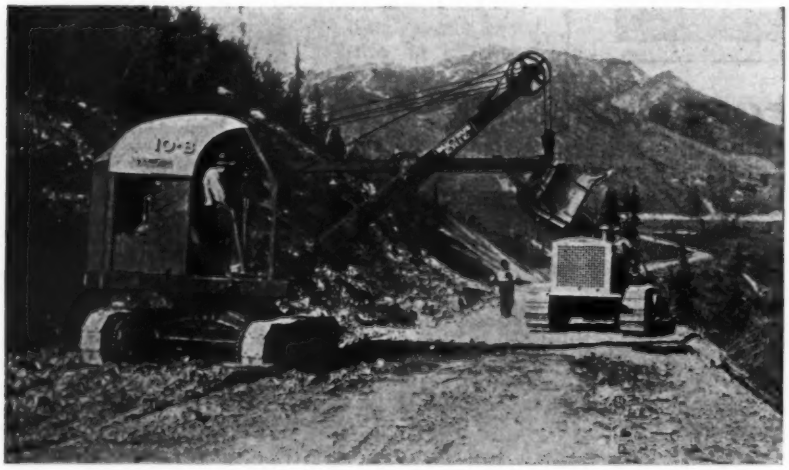
Nevada

Funds available for highway work in Nevada for the fiscal year July 1, 1936 to June 30, 1937, are reported as $2,900,000 by E. W. Harris, Office Engineer. This is a decrease of about 55 per cent from 1936. It is planned to spend $1,800,000 on construction, $800,000 on maintenance, and $300,000 for other purposes. Sources of this income are: Hayden-Cartwright Act, $1,600,000; state gas tax, $1,000,000; vehicle license tax, $300,000.

The 1937 fiscal year program, largely complete at this date, involves 16 miles of grading; 106 miles of roadmix asphaltic surface (oil and mixing only); 5 miles of roadmix asphaltic surface reconstruction; 1 overpass with approaches; 5 miles of roadside beautification.

Nevada's allotment for the fiscal year 1938 under the 1936 Hayden-Cartwright Act includes $1,595,000 regular Federal Aid; $553,000 Federal Lands; $320,000 feeder roads; $220,000 grade crossing elimination. These funds, available for use July 1, 1937, can be placed under agreement January 1, 1937.

There was no diversion of highway funds in Nevada in 1936.



• *Alaska Road Commission has averaged 400 yards a day with its Bucyrus-Erie 10-B. Here, the ⅝-yard shovel is shown working in Mount McKinley Park. Final grading is being handled by the Caterpillar 75 pulling an Adams grader which is hidden by the tractor.*

THE "QUINS" OF QUALITY

BRING YOU A WELL-BALANCED WIRE ROPE

It takes more than strength alone to carry the load on present-day construction work. The other members of those famous Leschen "Quins"—durability, toughness, flexibility and elasticity—each lend a helping hand to bring you a well-balanced wire rope. No one of them slights its job at the expense of the others.

And therein lies the reason for the longer service which you are receiving from "HERCULES" (Red Strand) Wire Rope, because the correct balance of strength, durability, toughness, flexibility and elasticity is important if you want an all-around, heavy duty wire rope.

Start the New Year right with the resolution to specify "HERCULES" (Red-Strand) Wire Rope. It's a resolution that you'll never break once you've tried some.

CONSTRUCTION

So that you will receive the maximum in service by avoiding misapplication, we make "HERCULES" (Red-Strand) Wire Rope in a wide range of constructions, including Round Strand, Flattened Strand, Preformed, Non-Rotating and Steel Clad types. If you will tell us how you use wire rope, we shall be glad to suggest the construction we consider best for your work.

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Existing State Highway Mileage—1935

As reported by U. S. Bureau of Public Roads

STATE	TOTAL EXISTING MILEAGE: ROADS AND STREETS UNDER STATE CONTROL (COL. 2 + COL. 5)	TOTAL EXISTING MILEAGE: RURAL ROADS UNDER STATE CONTROL: TOTAL RURAL ROADS (COL. 3 + COL. 4)	RURAL ROADS UNDER STATE CONTROL: PRIMARY STATE ROAD SYSTEM	RURAL ROADS UNDER STATE CONTROL: SECONDARY ROAD SYSTEM 2/	URBAN EXTENSIONS OR CONNECTING STREETS: ON DESIGNATED STATE SYSTEM	URBAN EXTENSIONS OR CONNECTING STREETS: NOT ON DESIGNATED STATE SYSTEM	TOTAL INCLUDING CONNECTING STREETS NOT ON SYSTEM (COL. 1 + COL. 6)	SURFACED ROAD MILEAGE: ROADS AND STREETS UNDER STATE CONTROL (COL. 9 + COL. 12)	RURAL ROADS UNDER STATE CONTROL: TOTAL	RURAL ROADS UNDER STATE CONTROL: PRIMARY STATE ROAD SYSTEM	RURAL ROADS UNDER STATE CONTROL: SECONDARY ROAD SYSTEM 2/	URBAN EXTENSIONS ON DESIGNATED STATE SYSTEM	NON-SURFACED ROAD MILEAGE: ROADS AND STREETS UNDER STATE CONTROL (COL. 14 AND COL. 17)	RURAL ROADS UNDER STATE CONTROL: TOTAL	RURAL ROADS UNDER STATE CONTROL: PRIMARY STATE ROAD SYSTEM	RURAL ROADS UNDER STATE CONTROL: SECONDARY ROAD SYSTEM 2/	URBAN EXTENSIONS ON DESIGNATED STATE SYSTEM	STATE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	
ALABAMA	6,500	6,256	6,256	-	244	-	6,500	4,298	4,055	4,055	-	243	2,202	2,201	2,201	-	1	ALABAMA
ARIZONA	3,068	3,038	3,038	-	30	-	3,068	2,475	2,445	2,445	-	30	593	593	593	-	-	ARIZONA
ARKANSAS	9,116	8,938	8,938	-	178	-	9,116	7,776	7,598	7,598	-	178	1,340	1,340	1,340	-	-	ARKANSAS
CALIFORNIA	13,623	12,616	12,616	-	1,007	-	13,623	12,479	11,486	11,486	-	993	1,144	1,130	1,130	-	14	CALIFORNIA
COLORADO	9,421	9,328	3,559	5,769	93	-	9,421	5,500	5,407	2,951	2,456	93	3,921	3,921	608	3,313	-	COLORADO
CONNECTICUT	2,594	2,446	2,446	-	148	19	2,613	2,505	2,357	2,357	-	148	89	89	89	-	-	CONNECTICUT
DELAWARE 3/	3,850	3,830	1,659	2,171	20	25	3,875	1,679	1,659	1,659	-	20	2,171	2,171	-	2,171	-	DELAWARE
FLORIDA	12,184	11,689	11,689	-	495	-	12,184	7,676	7,189	7,189	-	487	4,508	4,500	4,500	-	8	FLORIDA
GEORGIA	9,234	9,146	9,146	-	88	-	9,234	5,376	5,307	5,307	-	69	3,858	3,839	3,839	-	19	GEORGIA
IDAHO	4,932	4,753	4,753	-	179	-	4,932	3,553	3,377	3,377	-	176	1,379	1,376	1,376	-	3	IDAHO
ILLINOIS	10,835	10,204	10,204	-	631	141	10,976	10,655	10,033	10,033	-	622	180	171	171	-	9	ILLINOIS
INDIANA	9,766	9,304	9,304	-	462	-	9,766	8,974	8,512	8,512	-	462	792	792	792	-	-	INDIANA
IOWA	9,283	8,278	8,278	-	1,005	-	9,283	8,987	7,995	7,995	-	992	296	283	283	-	13	IOWA
KANSAS	9,614	9,095	9,095	-	519	-	9,614	7,064	6,583	6,583	-	481	2,550	2,512	2,512	-	38	KANSAS
KENTUCKY	8,238	8,238	8,238	-	(4/)	-	8,238	7,449	7,449	7,449	-	-	789	789	789	-	-	KENTUCKY
LOUISIANA	17,691	17,464	4,446	13,018	227	-	17,691	11,969	11,753	4,342	7,411	216	5,722	5,711	104	5,607	11	LOUISIANA
MAINE	8,186	8,049	2,435	5,614	137	11	8,197	6,834	6,698	2,351	4,347	136	1,352	1,351	84	1,267	1	MAINE
MARYLAND	3,927	3,871	3,871	-	56	-	3,927	3,927	3,871	3,871	-	56	-	-	-	-	-	MARYLAND
MASSACHUSETTS	1,860	1,706	1,706	-	154	247	2,107	1,860	1,706	1,706	-	154	-	-	-	-	-	MASSACHUSETTS
MICHIGAN	9,460	8,431	8,431	-	1,029	-	9,460	8,761	7,732	7,732	-	1,029	699	699	699	-	-	MICHIGAN
MINNESOTA	11,339	10,926	10,926	-	413	-	11,339	10,832	10,421	10,421	-	411	507	505	505	-	2	MINNESOTA
MISSISSIPPI	6,078	6,024	3,940	2,084	54	-	6,078	5,832	5,780	3,714	2,066	52	246	244	226	18	2	MISSISSIPPI
MISSOURI	13,442	13,380	8,156	5,224	62	-	13,442	12,631	12,569	7,965	4,604	62	811	811	191	620	-	MISSOURI
MONTANA	5,524	5,501	5,131	370	23	-	5,524	4,471	4,448	4,078	370	23	1,053	1,053	1,053	-	-	MONTANA
NEBRASKA 5/	11,142	10,547	10,547	-	595	-	11,142	7,373	6,948	6,948	-	425	3,769	3,599	3,599	-	170	NEBRASKA
NEVADA	4,885	4,864	2,688	2,176	21	-	4,885	2,428	2,408	2,323	85	20	2,457	2,456	365	2,091	1	NEVADA
NEW HAMPSHIRE	3,300	3,300	1,464	1,836	-	101	3,401	3,300	3,300	1,464	1,836	-	-	-	-	-	-	NEW HAMPSHIRE
NEW JERSEY	1,952	1,409	1,409	-	543	49	2,001	1,849	1,348	1,348	-	501	103	61	61	-	42	NEW JERSEY
NEW MEXICO	10,248	10,095	10,095	-	153	-	10,248	3,723	3,594	3,594	-	129	6,525	6,501	6,501	-	24	NEW MEXICO
NEW YORK	13,911	13,911	13,911	-	-	776	14,687	12,516	12,516	12,516	-	-	1,395	1,395	1,395	-	-	NEW YORK
NORTH CAROLINA	58,222	57,847	10,799	47,048	375	481	58,703	26,354	25,980	10,026	15,954	374	31,868	31,867	773	31,094	1	NORTH CAROLINA
NORTH DAKOTA	7,353	7,338	7,338	-	15	11	7,364	6,235	6,220	6,220	-	15	1,118	1,118	1,118	-	-	NORTH DAKOTA
OHIO	14,330	12,203	12,203	-	2,127	-	14,330	14,244	12,134	12,134	-	2,110	86	69	69	-	17	OHIO
OKLAHOMA	7,640	7,640	7,640	-	-	162	7,802	6,482	6,482	6,482	-	-	1,158	1,158	1,158	-	-	OKLAHOMA
OREGON	6,782	6,643	4,610	2,033	139	-	6,782	5,663	5,524	4,070	1,454	139	1,119	1,119	540	579	-	OREGON
PENNSYLVANIA	35,480	33,234	12,974	20,260	2,246	-	35,480	28,765	28,599	12,084	14,515	2,186	6,695	6,635	890	5,745	60	PENNSYLVANIA
RHODE ISLAND	1,121	1,019	1,019	-	102	3	1,124	749	679	679	-	70	372	340	340	-	32	RHODE ISLAND
SOUTH CAROLINA	5,996	5,996	5,996	-	(4/)	-	5,996	5,612	5,612	5,612	-	-	384	384	384	-	-	SOUTH CAROLINA
SOUTH DAKOTA	5,987	5,959	5,959	-	28	36	6,023	5,129	5,101	5,101	-	28	858	858	858	-	-	SOUTH DAKOTA
TENNESSEE	7,446	7,181	7,181	-	265	-	7,446	6,950	6,685	6,685	-	265	496	496	496	-	-	TENNESSEE
TEXAS	20,461	20,461	20,461	-	(6/)	581	21,042	14,977	14,977	14,977	-	-	5,484	5,484	5,484	-	-	TEXAS
UTAH	5,127	4,694	4,694	(7/)	433	-	5,127	3,113	2,717	2,717	-	396	2,014	1,977	1,977	-	37	UTAH
VERMONT	1,765	1,765	1,765	-	-	102	1,867	1,742	1,742	1,742	-	-	23	23	23	-	-	VERMONT
VIRGINIA	46,162	46,162	9,122	37,040	(6/)	-	46,162	25,735	25,735	7,878	17,857	-	20,427	20,427	1,244	19,183	-	VIRGINIA
WASHINGTON	3,797	3,542	3,542	-	255	-	3,797	3,586	3,331	3,331	-	255	211	211	211	-	-	WASHINGTON
WEST VIRGINIA	33,816	33,630	4,670	28,960	186	-	33,816	8,562	8,376	4,087	4,289	186	25,254	25,254	583	24,671	-	WEST VIRGINIA
WISCONSIN	10,094	9,982	9,982	-	112	378	10,472	9,657	9,545	9,545	-	112	437	437	437	-	-	WISCONSIN
WYOMING	3,569	3,537	3,537	-	32	-	3,569	3,097	3,068	3,068	-	29	472	469	469	-	3	WYOMING
TOTAL	520,351	505,470	331,867	173,603	14,881	3,123	523,474	371,424	357,051	279,807	77,244	14,373	148,927	148,419	52,060	96,359	508	TOTAL

1/ THIS TABLE GIVES THE EXISTING MILEAGE, ON DECEMBER 31, 1935, OF ROADS AND STREETS UNDER THE JURISDICTION OR CONTROL OF THE STATE HIGHWAY DEPARTMENTS, INCLUDING CITY STREETS DESIGNATED AS EXTENSIONS OF THE STATE HIGHWAY SYSTEMS. INCOMPLETE DATA ON CONNECTING STREETS NOT ON THE DESIGNATED STATE SYSTEMS ARE LISTED AS SUPPLEMENTARY INFORMATION IN COLUMN 6. FOR FURTHER DETAIL ON PRIMARY SYSTEMS, SEE TABLE SM-2; ON SECONDARY ROADS UNDER STATE CONTROL, TABLE SM-3; AND ON URBAN EXTENSIONS, TABLE SM-4.

2/ IN THIS COLUMN ARE INCLUDED THE FOLLOWING: SECONDARY STATE HIGHWAYS IN COLORADO, LOUISIANA, MISSISSIPPI, MISSOURI, MONTANA, NEVADA, OREGON, AND PENNSYLVANIA; STATE-AID SYSTEM IN MAINE AND NEW HAMPSHIRE; COUNTY ROADS UNDER STATE CONTROL IN DELAWARE (TAKEN OVER BY LEGISLATIVE ACT IN 1935), NORTH CAROLINA, VIRGINIA (ALL BUT 3 COUNTIES), AND WEST VIRGINIA.

3/ INCREASE OVER 1934 MILEAGE DUE TO ADDITION OF 431 MILES OF COUNTY ROADS TO PRIMARY SYSTEM AND ADDITION OF 2,171 MILES OF COUNTY ROADS AS SECONDARY SYSTEM, BY LEGISLATIVE ACT.

4/ CONNECTING STREETS IN CITIES OF LESS THAN 3,000 POPULATION IN KENTUCKY AND LESS THAN 2,500 IN SOUTH CAROLINA ARE INCLUDED WITH RURAL STATE HIGHWAYS. CONNECTING STREETS IN LARGER CITIES ARE NOT INCLUDED IN THE SYSTEM AND THEIR MILEAGE WAS NOT REPORTED.

5/ INCREASE OVER 1934 MILEAGE DUE TO ADDITION OF 1,391 MILES OF LOCAL ROADS TO PRIMARY STATE SYSTEM.

6/ URBAN EXTENSIONS OF STATE SYSTEM INCLUDED WITH PRIMARY RURAL ROADS, AS THEY WERE REPORTED WITHOUT SEGREGATION BY TYPES. TOTALS AS FOLLOWS: TEXAS, 730; VIRGINIA, 218.

7/ SECONDARY STATE HIGHWAY SYSTEM, REPORTED AS 655 MILES IN 1934, MERGED WITH PRIMARY STATE SYSTEM IN 1935.

New Hampshire

With a highway expenditure of $6,800,000 planned for 1937, New Hampshire will spend about the same amount of money for its road program as last year, according to the State Highway Department.

Funds will be obtained as follows: Hayden - Cartwright Act, $600,000; other Federal funds, $1,750,000; state gas tax, $2,300,000; vehicle license fees and other sources, $2,150,000. This money will be used for construction, $3,400,000; maintenance, $2,500,000; and other purposes, $900,000.

An approximate division of funds is programmed as follows: 150 miles of grading to cost $2,200,000 and involving 3,100,000 yards of material; 145 miles of gravel or crushed stone to cost $500,000, requiring 1,200,000 yards of material; 110 miles of oil treatment for $70,000 requiring 1,000,000 gallons of material; 10 miles of high type paving to cost $220,000; 4 miles of low type paving to cost $30,000; and 30 bridges to total $300,000.

No highway funds were diverted in 1936 and 100,000 yards of previously awarded excavation work at a cost of $70,000 will be carried over into 1937.

New Jersey

A highway program for 1937 cannot be determined until the New Jersey legislature is in session. Appropriations depend upon action taken at that time, and although at this early date no definite indication is given as to what course might be pursued, it is expected that the program will be in excess of last year, according to the State Highway Department.

National Park Road Funds

From Statement by Bureau of Public Roads as of October 31, 1936

STATES	Under Construction	Not Under Construction: Under Contract	Not Under Construction: Not Under Contract	TOTAL
Arizona	35,823.00		524,418.00	560,241.00
Arkansas	238,800.00		51,650.00	290,450.00
California	880,765.00		986,030.00	1,866,795.00
Colorado	150,239.00	251,840.00	185,300.00	587,379.00
District of Columbia		124,022.00	72,250.00	196,272.00
Florida			25,850.00	25,850.00
Georgia			85,147.00	85,147.00
Louisiana	66,060.00			66,060.00
Maine	800.00		841,500.00	842,300.00
Mississippi	50,036.00		375,000.00	425,036.00
Montana	463,914.00	130,300.00	223,040.00	817,254.00
Nebraska	162,545.00			162,545.00
New Jersey	50,100.80	2,300.00		52,400.00
New Mexico	40,740.00			40,740.00
North Carolina	3,486,829.00	682,986.00	742,104.00	4,911,919.00
Oregon	247,500.00	198,000.00	59,400.00	504,900.00
Pennsylvania	12,811.00	146,500.00		159,311.00
South Dakota	31,792.00			31,792.00
Tennessee	1,039,255.00			1,039,255.00
Utah		250,000.00		250,000.00
Virginia	3,777,264.00		934,781.00	4,712,045.00
Washington	728,595.00	163,350.00	397,980.00	1,289,925.00
Wyoming	1,197,955.00	103,500.00	611,418.00	1,912,873.00
TOTAL	12,661,823.00	2,052,798.00	6,115,868.00	20,830,489.00

Total Unauthorized 352,058.00

Federal Aid allotted to date amounts to $1,675,000. Other funds for grade crossings, road and street construction will be allotted later. No information is available as to how much of the above sum has been obligated.

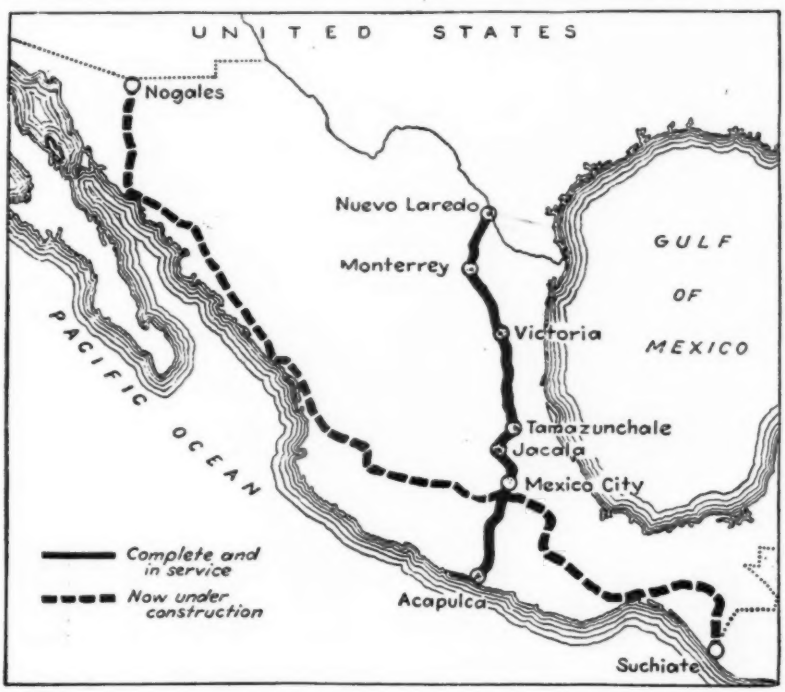
New Mexico

Tentative information from the New Mexico State Highway Department shows that $6,750,000 will probably be available for 1937 highway work. Construction work will total $5,000,000; maintenance, $1,250,000; and other, $500,000. This represents a 10 per cent decrease from 1936 expenditures.

Federal Aid will supply $3,000,000; state gas tax, $1,250,000; state gas tax debentures, $2,000,000; and vehicle license fees and other, $500,000.

No data is yet available for the division of construction funds and the money and yardage carried over from last year.

There was no diversion of highway funds in New Mexico in 1936.



• *Progress in Mexico of the Pan-American Highway is shown in this map, published recently in the trade information bulletin of Ingenieria International.*

New York

The legislative set-up in New York is such that the money available for highway construction is not definitely settled on until well into April. State funds are entirely dependent on the action of the legislature which convened after January 1.

Federal allotments for 1937 will amount to approximately $6,150,000 regular Federal Aid; $3,300,000 for grading; $1,200,000 for Farm-to-Market roads.

North Carolina

An increase of 15 per cent in available highway funds will allow North Carolina an enlarged highway program for 1937, according to W. Vance Baise, State Highway Engineer. Construction

The CUT that cuts costs

RED ARCH dragline buckets are famous for the clean-cut way they dig right in and get their load. They are famous, too, for their balance ... their high-speed, non-spilling carry ... their quick, free dump! Correctly shaped for speed, RED ARCH buckets deliver more cycles per hour and more dirt per cycle. Strongly built of tough alloy steels, they stand up under hard, fast digging. Three styles—"AX", "AU", and "Y". All sizes from 3/8-yard to 14-yard. Write for bulletins.

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will amount to $13,100,000 and maintenance will take $12,500,000.

Construction funds will be divided as follows: 250 miles of grading costing $1,500,000; 300 miles of gravel or crushed stone costing $1,650,000; 350 miles of oil treatment costing $1,400,000; 105 miles of high type paving costing $2,650,000; 50 miles of low type paving costing $600,000; and bridges costing $5,300,000.

The revenue sources and percentages are as follows: Federal Aid, 18 per cent; Federal Works Program (highways and grade crossing), 11 per cent; Emergency Federal relief, 1 per cent; state gas tax and vehicle license fees, 70 per cent.

North Dakota

According to Research Engineer J. N. Roherty, North Dakota will have $6,600,000 available for 1937. $4,800,000 of this, to be used in construction, comes from Hayden-Cartwright allocations—$4,000,000 is available from 1935 and 1936 allotments without matching because there was no diversion of state highway funds. Maintenance funds of $1,800,000 will be available from estimated gas tax receipts of $1,200,000, and vehicle license fees of $600,000.

Grading to be undertaken comes to 400 miles, involving 7,000,000 yards, and a cost of $1,750,000. Gravel or crushed stone surfacing, 300 miles, 600,000 yards, $1,450,000. Low-type paving costing $600,000 and involving 250,000 tons of material will be done. Bridge and grade elimination work will amount to $1,000,000.

600,000 yards of work, costing $175,000, previously awarded, will be carried over into 1937.

• U. S. Forest Service has some tough maintenance jobs. Here is one of their motor graders at work on Pikes Peak Road, at an elevation of about 12,500 feet.

At least ten thousand bills relating to use of automotive vehicles and highways will be introduced in state legislatures during 1937, it is estimated by the National Highway Users Conference on the basis of records for recent years.

Use of motor vehicles is the "most legislated" of all human activities, the Conference declares, pointing to the fact that it provided state solons with approximately 9,000 ideas for new laws last year, when legislatures of only seven states held regular sessions. The coming year will find forty-three legislatures in regular sessions.

A review by the Conference of past legislative activities indicates "outstanding and indisputable trends" along the following lines: safety legislation, efforts to extend restrictive carrier regulations, diversion of proceeds of gasoline taxes and other motor vehicle imposts to non-highway expenditures, and efforts to increase gasoline taxes and other levies affecting use of motor vehicles and highways.

• Widening a highway junction near Salisbury, North Carolina, Piedmont Machinery & Equipment Company are using their Bucyrus-Erie 10-B.

Ohio

The highway program for Ohio will be planned from a budget estimated at $22,300,000, according to the Department of Highways. This total closely approximates highway expenditures for 1936.

From this total, $11,000,000 will be spent for construction and $11,300,000 will be used for maintenance and repairs. Sources of the budget are: Hayden-Cartwright Act, $4,565,000; state gas tax, $12,935,000 — $6,435,000 of which is allotted to construction and $6,500,000 to maintenance and repairs; and vehicle license fees, $4,800,000.

Funds will be divided as follows: 150 miles of high type paving to cost $8,000,000; 400 miles of low type paving to cost $2,000,000; and bridges, $1,000,000. Gravel or crushed stone and oil treatment are included under maintenance and repairs.

No highway funds were diverted in 1936.

Oklahoma

A complete forecast for Oklahoma cannot be given at the present time as details of the 1937 program are not complete. The highway program is based on a revenue of about $6,000,000 from Federal Aid of $2,937,406 and a like sum to be provided by the state.

In 1936 the program amounted to approximately $21,000,000 as follows: Federal Aid, $6,000,000; Works Progress highway and grade crossing funds, $9,000,000; WPA program, $2,000,000; and state funds for construction and maintenance, $4,000,000.

Oregon

Highway funds available in Oregon amount to approximately $17,500,000,

• *Highway relocation work at Ellicott City, Maryland, is shown in this picture. The Koehring shovel is kept busy by the string of Dumptors.*

(*Continued from page 56*)

a decrease of 15 per cent from 1936, according to information received from S. H. Probert, Office Engineer.

Sources of income are: Hayden-Cartwright Act, $3,500,000; other Federal funds $3,200,000; state gas tax, $7,100,000; vehicle license fees and other sources, $3,700,000. The total will be divided as follows: construction, $10,000,000; maintenance, $3,300,000; bond payments, right-of-way, surveys, administration, etc., $4,200,000.

The allocation of funds for construction, $6,000,000 of which has already been contracted, is as follows: 200 miles of grading at a cost of $3,700,000, involving 6,000,000 yards of material; 350 miles of gravel or crushed stone surfacing at a cost of $1,800,000; 230 miles of oil treatment at a cost of $600,000; 45 miles of high type paving at a cost of $1,200,000; 80 miles of low type paving at a cost of $600,000; and 40 bridges to total $2,100,000.

No highway funds were diverted in Oregon in 1936.

Pennsylvania

A. E. Keeley, Assistant Chief Engineer, reports that appropriations for the new fiscal year, starting June 1, have not yet been made, and consequently it is impossible to know what amounts will be available.

Last year, Pennsylvania had about $34,000,000 for state highway construction. Of this, $11,000,000 was made up of Federal Aid funds matched by state appropriations. It is likely that an approximately equal amount will be available for the coming year from the same source. In addition, $9,000,000 was received last year from Works Progress Highway funds, $11,000,000 grade crossing allotments, and about $3,000,000 from 100 per cent state construction funds.

Introduced at the last session of Congress, the plan proposed by T. E. Steiner for building super highways was not brought to a vote, although it did receive consideration at a hearing before the House Committee on Highways. With new information, and more detailed plans, it is now proposed to bring the super highway project before Congress early this month.

The present proposal calls for construction of four super highways from (1) Boston to San Francisco, (2) the Great Lakes to Florida, (3) the Canadian Border in Minnesota to Laredo, Texas, and (4) a super highway connecting New York with (1) and (2). Right of way is set at 450 feet with separate sections for private cars, trucks and buses, parking, drainage, and beautification, according to present plans. Financing would be by a 12 billion dollar bond issue, repaid by mileage and toll taxes on the users of the super highways.

Rhode Island

Available funds for highway work in Rhode Island amount to approximately $2,800,000, a 20 per cent increase over 1936 actual expenditures.

Sources of funds are: Hayden-Cartwright Act, $604,000, and state gas tax, $2,191,000. Division of the budget is as follows: construction, $1,500,000; maintenance, $900,000; and other work, $400,000. Allocation of construction funds is not completed at this date. About 150,000 yards of previously awarded excavation at a cost of $45,000 will be carried over into 1937.

South Carolina

At the present time it is impossible to forecast South Carolina's 1937 highway program, or to obtain definite figures on 1936 construction. Federal funds available for the fiscal year 1936, however, amounted to $7,450,000, being divided as follows: regular Federal Aid, $1,690,000; 1935 Emergency Relief Act, $2,700,000 for highways, and $3,060,000 for grade crossing elimination.

South Carolina's share of Federal funds for the fiscal year beginning July 1, 1937, will be $2,819,554.

South Dakota

A 25 per cent decrease from 1936 funds gives South Dakota, $5,400,000 for the 1937 highway budget, according to estimates prepared by H. E. Abell, Office Engineer.

The sources of funds are: Hayden-Cartwright Act, $1,100,000; other Federal funds, $3,000,000 available of which only $800,000 can be matched by the state; state gas tax, $2,000,000; vehicle license fees and other sources, $700,000. Construction planned amounts

• *Marion County, Oregon, operates this sand and gravel plant in the tall timber near Salem.*

State Highway Mileage Built in 1935

As reported by U. S. Bureau of Public Roads

STATE	TOTAL MILEAGE IMPROVED AND SURFACED					EARTH ROADS GRADED AND DRAINED				CLASSIFICATION OF NEW SURFACES BUILT																						STATE
	GRAND TOTAL	RURAL ROADS			URBAN EXTENSIONS OF STATE SYSTEMS	TOTAL IMPROVED	RURAL ROADS		URBAN EXTENSIONS OF STATE SYSTEMS	ON ALL ROADS AND STREETS UNDER STATE CONTROL					ON PRIMARY STATE SYSTEM (RURAL)					ON SECONDARY ROADS UNDER STATE CONTROL 2/					ON URBAN EXTENSIONS OF STATE SYSTEM 3/							
		TOTAL RURAL ROADS	PRIMARY STATE SYSTEM	SECONDARY ROADS UNDER STATE CONTROL 2/			PRIMARY STATE SYSTEM	SECONDARY ROADS UNDER STATE CONTROL - 2/		TOTAL NEW SURFACES	SUBTOTAL		ON NON-SURFACED ROADS	REPLACING OLD SURFACE		TOTAL NEW SURFACES	SUBTOTAL		ON NON-SURFACED ROADS	REPLACING OLD SURFACE		TOTAL NEW SURFACES	SUBTOTAL		ON NON-SURFACED ROADS	REPLACING OLD SURFACE		TOTAL NEW SURFACES	SUBTOTAL		ON NON-SURFACED ROADS	REPLACING OLD SURFACE		
											LOW-TYPE SURFACE 4/	HIGH-TYPE SURFACE 5/		OF OTHER TYPES	OF SAME TYPE		LOW-TYPE SURFACE 4/	HIGH-TYPE SURFACE 5/		OF OTHER TYPES	OF SAME TYPE		LOW-TYPE SURFACE 4/	HIGH-TYPE SURFACE 5/		OF OTHER TYPES	OF SAME TYPE		LOW-TYPE SURFACE 4/	HIGH-TYPE SURFACE 5/		OF OTHER TYPES	OF SAME TYPE	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	
ALABAMA	377	368	368	-	15	35	34	-	1	342	294	46	107	233	2	288	289	39	107	221	-	-	-	-	-	-	-	14	5	9	-	12	2	ALABAMA
ARIZONA	177	175	175	-	2	89	89	-	-	146	126	20	42	63	63	146	125	21	42	63	61	-	-	-	-	-	-	2	1	1	-	-	2	ARIZONA
ARKANSAS	300	295	295	-	5	3	3	-	-	297	208	89	58	128	111	292	208	84	58	147	107	-	-	-	-	-	-	5	-	5	-	1	4	ARKANSAS
CALIFORNIA	780	727	727	-	53	38	34	-	4	742	562	180	438	198	106	693	578	115	435	184	76	-	-	-	-	-	-	49	4	45	3	14	32	CALIFORNIA
COLORADO	730	725	423	302	5	42	5	37	-	688	687	1	94	361	233	418	417	1	18	302	98	265	265	-	76	58	131	5	5	-	-	1	4	COLORADO
CONNECTICUT	143	141	141	-	2	6	6	-	-	137	48	89	125	10	2	135	48	87	123	10	2	-	-	-	-	-	-	2	-	2	2	-	-	CONNECTICUT
DELAWARE	187	186	186	-	1	-	-	-	-	187	66	121	52	20	115	186	66	120	52	20	114	-	-	-	-	-	-	1	-	1	-	-	1	DELAWARE
FLORIDA	301	283	283	-	18	108	107	-	1	193	170	23	124	27	42	176	168	8	116	16	42	-	-	-	-	-	-	17	2	15	6	11	-	FLORIDA
GEORGIA	816	816	816	-	-	158	158	-	-	658	513	145	355	260	63	658	513	145	355	260	63	-	-	-	-	-	-	-	-	-	-	-	-	GEORGIA
IDAHO	304	290	290	-	14	19	19	-	-	285	285	-	75	97	113	271	271	-	69	95	107	-	-	-	-	-	-	14	14	-	6	2	6	IDAHO
ILLINOIS	269	259	259	-	10	53	53	-	-	216	-	216	192	9	15	206	-	206	186	9	11	-	-	-	-	-	-	10	-	10	6	-	4	ILLINOIS
INDIANA	205	189	189	-	16	10	10	-	-	195	103	92	41	60	94	179	103	76	41	51	87	-	-	-	-	-	-	16	-	16	-	9	7	INDIANA
IOWA	659	612	612	-	47	95	89	-	6	564	470	94	183	64	317	523	451	72	171	58	294	-	-	-	-	-	-	41	19	22	12	6	23	IOWA
KANSAS	2,515	2,503	2,503	-	12	142	141	-	1	2,373	2,326	47	462	75	1,816	2,362	2,323	39	471	75	1,816	-	-	-	-	-	-	11	3	8	11	-	-	KANSAS
KENTUCKY	1,053	1,041	1,041	-	12	429	429	-	-	686	599	75	312	197	115	612	548	64	311	186	115	-	-	-	-	-	-	12	1	11	1	11	-	KENTUCKY
LOUISIANA	228	220	142	78	8	37	37	10	-	191	118	73	91	78	82	115	50	65	43	69	3	66	66	2	45	7	16	8	8	6	3	2	3	LOUISIANA
MAINE	230	225	30	195	5	-	-	-	-	230	213	17	167	33	30	30	19	11	8	16	6	195	193	2	189	14	22	5	1	4	-	3	2	MAINE
MARYLAND	94	91	91	-	3	-	-	-	-	94	30	64	72	22	-	91	30	61	72	19	-	-	-	-	-	-	-	3	-	3	-	3	-	MARYLAND
MASSACHUSETTS	89	76	76	-	13	-	-	-	-	89	1	88	21	47	21	76	1	75	18	41	17	-	-	-	-	-	-	13	-	13	3	6	4	MASSACHUSETTS
MICHIGAN	265	265	265	-	-	50	50	-	-	215	109	106	108	60	47	215	109	106	108	60	47	-	-	-	-	-	-	-	-	-	-	-	-	MICHIGAN
MINNESOTA	1,187	1,170	1,170	-	17	31	31	-	-	1,156	1,090	66	132	573	451	1,139	1,087	52	132	564	443	-	-	-	-	-	-	17	3	14	-	9	8	MINNESOTA
MISSISSIPPI	455	451	311	140	4	166	163	2	1	289	223	66	121	136	34	248	185	63	106	122	20	38	38	-	15	10	13	3	-	3	-	2	1	MISSISSIPPI
MISSOURI	1,779	1,765	479	1,286	14	342	31	311	-	1,437	1,266	171	1,035	315	87	446	332	114	87	294	67	375	933	42	937	19	19	11	1	13	11	2	1	MISSOURI
MONTANA	772	771	661	110	1	13	13	-	-	759	758	1	317	442	-	648	648	-	226	422	-	110	109	1	91	19	-	1	1	-	-	1	-	MONTANA
NEBRASKA	708	691	691	-	17	60	60	-	-	648	541	107	128	186	334	631	541	90	114	185	332	-	-	-	-	-	-	17	-	17	14	1	2	NEBRASKA
NEVADA	521	521	481	40	-	-	-	-	-	521	520	1	83	371	67	481	480	1	53	361	67	40	40	-	30	10	-	-	-	-	-	-	-	NEVADA
NEW HAMPSHIRE	119	118	23	95	1	-	-	-	-	119	112	7	77	17	85	23	16	7	7	7	16	95	95	-	77	9	9	1	1	-	-	1	-	NEW HAMPSHIRE
NEW JERSEY	31	19	19	-	12	-	-	-	-	31	-	31	9	16	6	19	-	19	7	9	3	-	-	-	-	-	-	12	-	12	2	7	3	NEW JERSEY
NEW MEXICO	581	569	569	-	12	29	29	-	-	552	343	9	163	150	39	340	332	8	163	138	39	-	-	-	-	-	-	12	11	1	-	12	-	NEW MEXICO
NEW YORK	322	295	295	-	27	32	24	-	8	290	82	208	79	188	23	271	82	189	69	180	22	-	-	-	-	-	-	19	-	19	10	8	1	NEW YORK
NORTH CAROLINA	543	520	393	85	23	12	12	-	-	531	475	56	227	271	33	483	447	36	201	262	20	25	25	-	25	-	-	23	3	20	1	9	13	NORTH CAROLINA
NORTH DAKOTA	1,268	1,261	1,261	-	7	130	130	-	-	1,138	1,129	9	304	53	781	1,131	1,126	5	304	148	779	-	-	-	-	-	-	7	3	4	-	5	2	NORTH DAKOTA
OHIO	295	258	258	-	37	13	12	-	1	282	63	219	37	148	37	246	61	185	32	126	88	-	-	-	-	-	-	36	2	34	5	22	9	OHIO
OKLAHOMA	467	447	447	-	20	113	111	-	2	354	280	74	333	21	-	336	278	58	317	19	-	-	-	-	-	-	-	18	2	16	16	2	-	OKLAHOMA
OREGON	199	191	118	73	8	44	19	25	-	155	125	30	43	72	40	99	61	18	32	47	20	48	44	4	11	23	14	8	-	8	-	2	6	OREGON
PENNSYLVANIA	482	470	182	288	12	9	3	6	-	473	138	335	322	103	48	179	35	144	75	73	31	262	100	162	239	12	11	32	3	29	8	18	6	PENNSYLVANIA
RHODE ISLAND	27	27	27	-	-	-	-	-	-	27	14	13	15	11	1	27	14	13	15	11	1	-	-	-	-	-	-	-	-	-	-	-	-	RHODE ISLAND
SOUTH CAROLINA	369	364	364	-	5	30	30	-	-	339	336	3	91	233	15	334	333	1	87	232	15	-	-	-	-	-	-	5	3	2	4	1	-	SOUTH CAROLINA
SOUTH DAKOTA	1,363	1,360	1,360	-	3	9	9	-	-	1,354	1,322	32	67	154	1,113	1,351	1,322	29	87	151	1,113	-	-	-	-	-	-	3	-	3	-	3	-	SOUTH DAKOTA
TENNESSEE	152	142	142	-	10	30	30	-	-	122	54	68	80	39	3	112	54	58	80	31	1	-	-	-	-	-	-	10	-	10	-	8	2	TENNESSEE
TEXAS	2,238	2,209	2,209	-	29	641	637	-	4	1,597	1,311	286	804	641	92	1,572	1,307	265	842	638	92	-	-	-	-	-	-	25	4	21	22	3	-	TEXAS
UTAH	309	291	291	-	18	17	17	-	-	292	247	45	67	141	84	274	241	33	67	139	68	-	-	-	-	-	-	18	6	12	-	2	16	UTAH
VERMONT	66	61	61	-	5	18	18	-	-	48	42	6	5	41	2	43	39	4	5	36	2	-	-	-	-	-	-	5	3	2	-	5	-	VERMONT
VIRGINIA	320	303	301	2	17	19	19	-	-	301	260	41	46	177	78	282	246	36	46	165	71	2	2	-	-	2	-	17	12	5	-	10	7	VIRGINIA
WASHINGTON	349	330	330	-	19	28	28	-	-	321	205	116	28	220	73	302	202	100	27	213	62	-	-	-	-	-	-	19	3	16	1	7	11	WASHINGTON
WEST VIRGINIA	461	455	273	182	6	94	43	51	-	367	244	123	229	138	15	230	113	117	106	109	15	131	131	-	112	19	-	6	-	6	3	3	-	WEST VIRGINIA
WISCONSIN	1,169	1,155	1,155	-	14	-	-	-	-	1,169	1,056	113	2	1,042	109	1,155	1,046	99	1	1,052	102	-	-	-	-	-	-	14	-	14	1	10	3	WISCONSIN
WYOMING	740	736	736	-	4	150	149	-	1	590	590	-	176	322	92	587	587	-	173	322	92	-	-	-	-	-	-	3	3	-	3	-	-	WYOMING
TOTAL	26,814	26,211	23,515	2,696	603	3,264	2,812	442	30	23,530	19,784	3,806	8,231	8,234	7,065	20,703	17,562	3,141	6,260	7,798	6,645	2,254	2,041	213	1,817	202	235	573	121	452	154	234	185	TOTAL

1/ THIS TABLE IS A SUMMARY OF MILEAGE BUILT DURING THE CALENDAR YEAR 1935 ON ROADS AND STREETS UNDER THE JURISDICTION OR CONTROL OF THE STATE HIGHWAY DEPARTMENTS, INCLUDING CITY STREETS FORMING URBAN CONNECTIONS OF THE STATE HIGHWAY SYSTEMS. FOR FURTHER DETAIL ON PRIMARY SYSTEMS SEE TABLE 948-2; ON SECONDARY ROADS UNDER STATE CONTROL, TABLE 948-3; AND ON URBAN EXTENSIONS, TABLE 948-4.

2/ ROADS INCLUDED UNDER THIS HEADING ARE AS FOLLOWS: SECONDARY STATE HIGHWAYS IN COLORADO, LOUISIANA, MISSISSIPPI, MISSOURI, MONTANA, NEVADA, OREGON, AND PENNSYLVANIA; STATE-AID SYSTEMS IN MAINE AND NEW HAMPSHIRE; AND COUNTY ROADS UNDER STATE CONTROL IN DELAWARE, NORTH CAROLINA, VIRGINIA (ALL BUT 3 COUNTIES), AND WEST VIRGINIA.

3/ UNDER THIS HEADING IS INCLUDED ALL CONSTRUCTION REPORTED BY THE STATE HIGHWAY DEPARTMENTS ON MUNICIPAL STREETS CONNECTING THE STATE HIGHWAY SYSTEMS, WHETHER OR NOT SUCH STREETS ARE A PART OF THE DESIGNATED STATE HIGHWAY SYSTEM.

4/ INCLUDES TOPSOIL AND SAND-CLAY, UNTREATED AND TREATED; GRAVEL, CHERT, SHALE, ETC., UNTREATED AND TREATED; WATERBOUND MACADAM, UNTREATED AND TREATED; AND LOW-COST BITUMINOUS MIXES.

5/ INCLUDES BITUMINOUS MACADAM, BITUMINOUS CONCRETE AND SHEET ASPHALT, PORTLAND CEMENT CONCRETE, BRICK AND BLOCK PAVEMENTS.

to $2,800,000; maintenance, $2,000,000; and other work, $600,000.

The 1937 funds will be divided as follows: 150 miles of grading at a cost of $800,000, involving 3,000,000 yards of material; 100 miles of gravel or crushed stone surfacing to cost $200,000, requiring 200,000 yards of material; 150 miles of oil treatment at a cost of $800,000; 23 miles of high type paving at a cost of $600,000; and 50 bridges to total $400,000. Previously awarded excavation carried over involves 1,600,000 yards at a cost of $320,000.

In 1936 approximately $2,000,000 was diverted.

Tennessee

It has not been possible to obtain a forecast of highway work in Tennessee for 1937, or final figures on 1936 construction. Preliminary construction estimates, however, put construction total at $9,756,000—derived from $1,575,000 regular Federal Aid; $8,096,000 1935 Works Relief Bill; and Federal Relief (NIRA), $85,000.

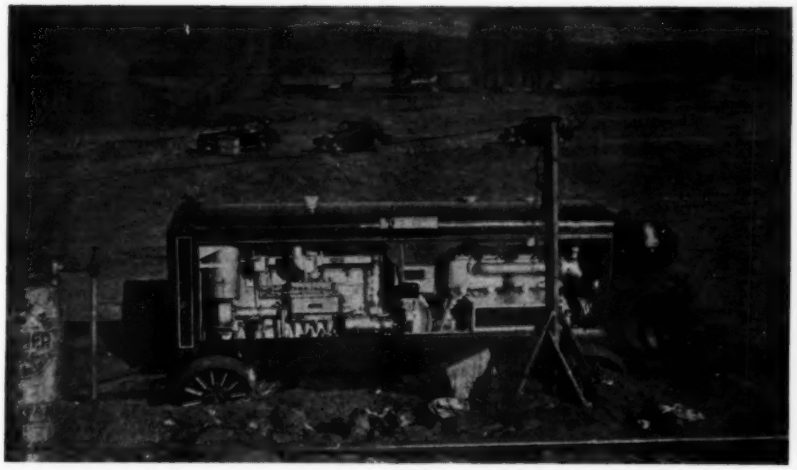
Revenue from state gasoline and vehicle taxes, estimated at $3,500,000, provided for maintenance and other departmental expenses.

Texas

Construction contracts for Texas highways during the fiscal year ending August 31, 1936, amounted to $51,625,846. These contracts covered the following: landscape projects, $196,093; 1,295 miles of grading, $10,742,943; 1,048 miles of gravel, caliche and similar surfaces, $6,395,786; 1,123 miles of asphalt surfacing, $8,908,490; 301 miles of concrete and brick, $8,047,200; bridges amounting to $8,098,451; and overpasses and underpasses totaling $9,236,884.

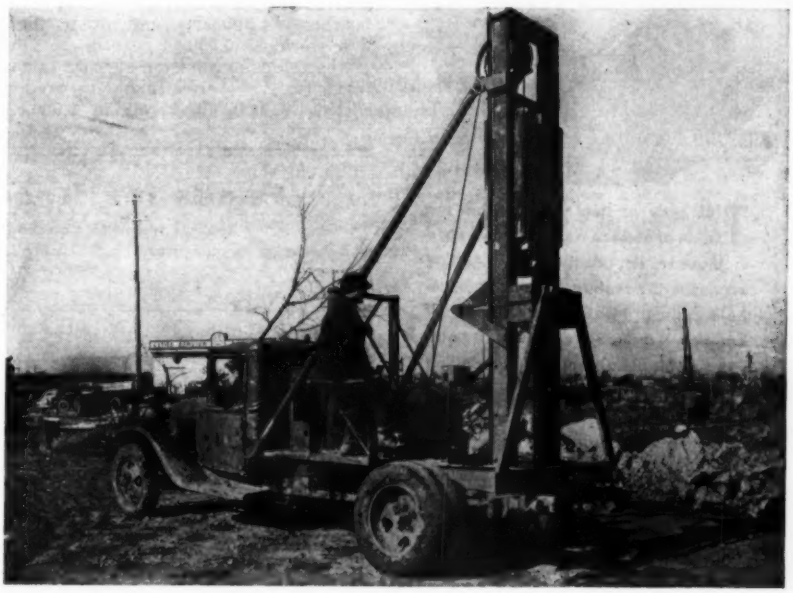
In this same period construction completed was as follows: landscape projects, $190,175; 787 miles of grading and small structures at a cost of $9,133,152; 468 miles of gravel and caliche surfacing, $3,344,681; 968 miles of asphalt surfacing for $7,667,608; 320 miles of concrete and brick, $8,290,245; large bridges costing $1,181,271; and grade separation, $1,672,760.

The present fiscal year finds Texas with little more than state funds to match the 1937 regular Federal Aid. This is due to the fact that a large number of projects are now active, many of which are WPA projects which had to be supplemented with state funds. The regular Federal Aid amounts to $7,771,317, which, with the



● *In reconstructing U. S. Highway 395 near Sprague, Washington, F. H. De Atley & Company used this Schramm compressor. A Diesel engine-driven outfit, it is reported to be the largest portable compressor yet built, and attracted considerable attention from Northwest contractors on this job.*

● *Milwaukee County highway forces are shown here excavating for a road culvert, using Sullivan portable compressors and "Busters."*



● *Hamer Brothers of Detroit used the Novo pavement breaker shown here on a job at Flint, Michigan. Operating in below-zero weather, the outfit broke up 10-inch concrete reinforced with ¼-inch steel. Concrete already broken can be seen behind hammer and at right.*

matching sum, brings the total to $15,542,634. State projects will not exceed $2,000,000.

The numerous projects mentioned above as being active, on August 31, 1936, are: landscape projects, $105,119; 594 miles of grading and small structures, $7,427,741; 495 miles of gravel and caliche surfacing, $3,502,740; 698 miles of asphalt surfacing, $6,429,274; 121 miles of concrete and brick, $3,710,473; large bridges for $7,664,963; and grade separation, $9,822,380.

The 1937 regular Federal program has been approved by the Bureau of Public roads, for the following mileage: grading and small structures, 549 miles; gravel and caliche surfaces, 300 miles; asphalt surfaces, 258 miles; concrete and brick surfacing, 205 miles; and landscape projects, 10 miles. Thirteen large bridges have also been approved.

Apportionment of the regular Federal Aid has not been made, but the following amounts, in addition to the regular aid and its equivalent contributed by the state, will be available: Federal funds for secondary or Farm to Market Roads, $1,560,000: and Federal funds for grade separation, $2,710,000. The sum for secondary or Farm to Market Roads must be met by the state.

This gives Texas a total of $21,372,634 for highway work.

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Diversion in 1935

State	Collected For Road Financing From Gasoline Tax, Registration Fees, etc.	Diverted to Purposes Other Than Highway Financing	Proportion of Highway Tax Dollar Diverted	Increase or Decrease from 1934
Alabama	$ 13,797,000	$ 663,183	4.8c.	—3.7%
Arizona	4,126,000	192,344	4.7	—37.5
Arkansas	10,719,000	68,118	0.6	—72.7
California	50,534,000	1,282,510	2.5	+5700.0
Colorado	8,217,000	984,277	12.0	—64.8
Connecticut	14,010,000	103,375	0.7	—0.8
Delaware	2,488,000	561,169	22.6	
Florida	22,731,000	6,986,495	30.8	+10.4
Georgia	17,020,000	5,582,148	32.8	+133.6
Illinois	49,136,000	7,505,978	15.3	—12.3
Indiana	27,149,000	2,102,591	7.7	+9.9
Louisiana	12,908,000	1,869,184	14.5	+4.9
Maryland	12,378,000	463,148	3.7	+276.0
Massachusetts	23,654,000	9,527,668	40.3	—5.2
Michigan	40,740,000	352,161	0.9	—8.2
Minnesota	18,302,000	156,098	0.9	+187.9
Mississippi	8,253,000	775	—	——
Nebraska	11,711,000	1,113,218	9.5	——
New Jersey	34,808,000	5,821,030	16.7	+39.4
New Mexico	3,967,000	390,432	9.8	+31.6
New York	99,740,000	58,526,852	58.7	+28.8
North Carolina	24,973,000	1,757,462	7.0	+4.4
North Dakota	3,704,000	905,776	24.4	—17.7
Ohio	61,322,000	9,726,633	15.9	+3.2
Oklahoma	15,735,000	3,494,006	22.2	+9.8
Pennsylvania	72,862,000	5,161,045	7.1	+3180.0
Rhode Island	4,519,000	671,750	14.9	—3.7
South Carolina	10,433,000	140,880	1.3	+2305.0
South Dakota	5,572,000	2,356,601	42.3	+23.6
Tennessee	18,500,000	2,654,785	14.4	—20.1
Texas	49,387,000	8,290,061	16.8	+5.1
Virginia	18,492,000	28,849	0.2	—50.0
Washington	15,956,000	1,002,791	6.3	+5.8
West Virginia	10,611,000	2,392	22.5	——
Wisconsin	26,968,000	5,089,317	18.9	—2.1
D. of C.	3,102,000	924,589	29.8	+46.7
Total	$828,424,000	$146,459,711		

Note: States not appearing in this table had no diversions. Complete figures for 1936 are not yet available, but diversion statistics are given in the individual state forecasts wherever possible.

Utah

A 25 per cent decrease from 1936 expenditures will give Utah $5,800,000 for road work in 1937, according to H. V. Richards, Statistical Engineer.

Sources of revenue are as follows: Hayden-Cartwright Act, $1,400,000; other Federal funds, $900,000; state gas tax, $2,800,000. In addition there is a carry-over of $700,000 in Hayden-Cartwright funds. These funds will be used for construction, $4,000,000; maintenance, $1,300,000; and other highway work, $500,000.

The following division of work is outlined for 1937: 150 miles of grading costing $1,000,000, involving 2,000,000 yards of material; 60 miles of gravel or crushed stone costing $420,000, requiring 540,000 tons of material; 120 miles of oil treatment costing $475,000; 15 miles of high type paving costing $600,000; 30 miles of low type paving costing $350,000; and 25 bridges to total $1,155,000.

No highway funds were diverted in Utah in 1936.

Vermont

Funds available for 1937 work depend on action to be taken by the state legislature, and hence cannot be predicted at this time, according to a wire

Funds for Roads in Public Lands

From Statement by Bureau of Public Roads as of October 31, 1936

STATE	Unobligated and Not Under Construction	Under Construction	TOTAL
Arizona	$ 80,710.76	$ 280,471.00	$ 361,181.76
California	80,061.03	202,269.70	282,330.73
Colorado		115,245.24	115,245.24
Idaho	52,977.24		52,977.24
Montana	11,235.62		11,235.62
Nevada	6,060.86	336,059.59	342,120.45
New Mexico	10,343.37	163,218.07	173,561.44
North Dakota	45,412.30		45,412.30
Oklahoma	23,162.00		23,162.00
Oregon	1,990.65		1,990.65
South Dakota	75,952.09	20,528.91	96,481.00
Utah		123,584.28	123,584.28
Washington			
Wyoming	19,502.17		19,502.17
TOTALS	$ 407,408.09	$1,241,376.79	$1,648,784.88

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from the State Highway Department. Vermont's share of federal funds for the fiscal year 1938 will become available after July 1, 1937, including regular Federal Aid, grade crossing and secondary road apportionments.

Final figures for 1936 are not complete as we go to press, but estimates put last year's revenue at $4,500,000, $600,000 of which came from regular Federal Aid; $1,600,000 from the 1935 Works Relief Bill, and $2,300,000 from state gas tax receipts.

There was no diversion in Vermont in 1936. An estimated 300,000 yards of work, costing about $190,000 is being carried over into 1937.

Over ⅔ of county road and bridge construction is done by contract, according to a recent survey by Roads and Streets. Other data gathered included the average county budget for 1936:—road construction, $39,209; bridge construction, $20,000; maintenance, $74,200. County road expenditures were found to be fairly constant and uniform from year to year.

Virginia

For the fiscal year July 1, 1936 to June 30, 1937, Virginia will have about $6,749,650 available for construction of its primary highway system, according to Auditor C. J. Allard. In addition, $5,430,000 will be used for primary system maintenance. Construction and maintenance on secondary systems will take $6,608,405; and streets in cities and towns, $700,000 more. $1,662,610 will go to the Motor Vehicle Division, sinking fund interest. Thus, the total for the fiscal year 1937 will be $21,150,725, a decrease of 14 per cent from 1936.

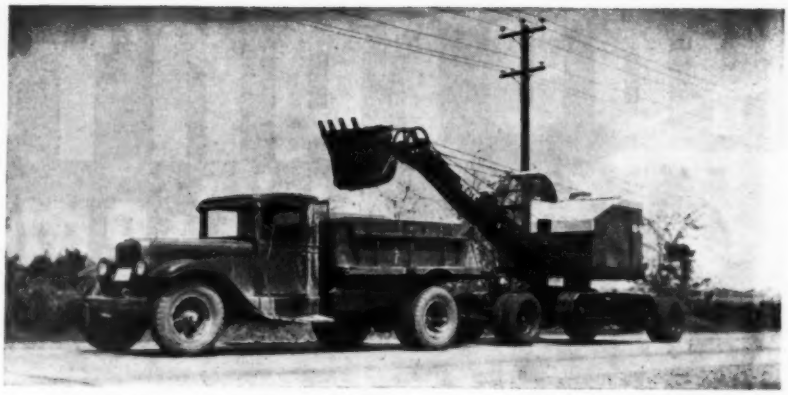
Funds will come from the following sources: Hayden-Cartwright Act, $2,280,725; State gas tax and vehicle license fees, $18,870,000. Details of the types of road comprising the program are not yet available.

Washington

Projects proposed for the year 1937 will amount to $10,180,000, a decrease of 15 per cent from the 1936 expenditures. Of this sum construction will require $6,940,000; maintenance, $2,500,000; and other work, $740,000, according to L. V. Murrow, Director of Highways.

Available for this work will be $3,150,000 in Federal Aid (including $800,000 allotted to the Grade Crossing program), $6,630,000 in state funds, and $400,000 in county funds.

A preliminary estimate shows the following division of work: 43 per cent for grading and surfacing, 17 per cent for bridges, 15 per cent for bituminous



• *Trailers, on which small shovels can be moved cross-country at truck speeds, are proving valuable to many highway departments.*

• *Woodworth-Cornell are the contractors laying this 4-lane pavement on Main Pacific Highway near Tacoma, Washington. The Jaeger Bituminous Paver puts down sections varying from 2 to 14½ feet wide and 1½ to 10 inches deep.*

• *Ditching is wet work on this wooded stretch of road in the state of Washington.*

BUCYRUS-ERIE

Years Ahead » »

in power capacity, in drilling speed, in dependable performance, and in constant savings, the famous Bucyrus-Armstrong 29-T blast-hole drill has long been the leader in its field. All over the world, in mines and quarries everywhere, the 29-T is "tops" with practical drillers. It offers the revolutionary features of rubber shock absorbers, fast strokes-per-minute speed, smashing blow, and rapid mobility that means more tonnage per drill and greater economy on every job. Bucyrus-Armstrong offers three modern blast-hole drills, the 26, 29-T, and 42-T. Write in today for complete information on the size drill that fits your needs.

BUCYRUS ARMSTRONG

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surfaces, and 18 per cent for paving, high type.

In addition to the work covered above, $2,500,000 will be carried over into 1937 from various awards. $1,000,000 of the 1936 funds were diverted for interest and redemption of relief bonds.

West Virginia

EXCAVATING
SO. MILWAUKEE, WIS.
REGRET THAT DUE TO INDEFINITENESS OF PLANS AND PROGRAM IT IS IMPOSSIBLE TO GIVE A FORECAST FOR NINETEEN-THIRTY-SEVEN.
M. W. SMITH, ENGINEER,
STATE ROAD COMMISSION.

In 1936, West Virginia had a total of approximately $13,190,000 for highway construction. Federal Aid came to $2,356,793; 1935 Work Relief Bill, $4,333,937; State bonds, $3,000,000; gas tax, $2,000,000; vehicle license fees, etc., $1,499,270.

Wisconsin

A total of $19,500,000 is expected to be available for highway work in Wisconsin during 1937, according to information from the State Highway Commission. This figure is about the same as was estimated for 1936, but is 15 per cent less than funds actually realized in 1936.

Federal funds of $4,915,000 are expected to be available, with $3,045,000 of this amount coming through the Hayden-Cartwright Act. State gas tax and vehicle license fees will furnish $11,500,000; and county bonds and local funds, $3,085,000.

Funds will be divided with $14,000,000 going for construction, and $5,000,000 for maintenance. Construction funds will be allocated as follows: grading, 350 miles, $3,000,000; surfacing—gravel or crushed stone, 450 miles, $2,000,000; high-type paving, 150 miles, $5,000,000; low-type paving, 150 miles, $1,000,000. Bridge construction to the tune of $3,000,000 is scheduled.

In addition to the above, 100,000 yards of highway excavation, previously awarded and costing $60,000, will be carried over into 1937.

There was no diversion of Wisconsin highway funds in 1936.

Wyoming

According to James B. True, State Highway Superintendent-Engineer, Wyoming will have highway funds totalling $4,408,500 in 1937, a decrease of 30 per cent from 1936. Of these funds, $3,426,750 will be used for construction, $775,000 for maintenance, and $206,750 for other purposes. The federal government will furnish $2,210,000 of Hayden-Cartwright funds.

Works Program Project Summary

Number of WPA Projects Placed in Operation by Types of Projects and Project Status Continental United States and Hawaii

Through September 30, 1936

(Preliminary — Subject to Revision)

	Total	Active	Completed and Inactive
Grand Total	102,683	51,006	51,677
Highways, Roads and Streets	32,852	15,161	17,691
Highways	383	193	190
Farm to Market and other secondary roads	14,087	7,058	7,029
Streets and alleys	6,859	2,774	4,085
Sidewalks, curbs and paths	2,445	1,074	1,371
Roadside improvements	2,424	742	1,682
Bridges and viaducts	1,603	580	1,023
Grade crossing elimination	15	6	9
Other a/	5,036	2,734	2,302
Public Buildings	15,880	6,669	9,211
Administrative	2,240	898	1,342
Charitable, medical and mental institutions	1,030	424	606
Educational	7,498	2,984	4,514
Social and recreational	1,897	985	912
Federal Government (incl. military and naval)	391	260	131
Improvement of grounds	2,052	763	1,289
Housing and Demolition	42	16	26
Other a/	730	339	391
Parks and Other Recreational Facilities	6,600	3,038	3,562
Playgrounds and athletic fields	2,573	1,030	1,543
Parks	2,783	1,406	1,377
Other a/	1,244	602	642
Conservation	4,353	1,932	2,421
Forestation	200	59	141
Erosion control and land utilization	376	163	213
Irrigation and water conservation	2,562	1,108	1,454
Plant, crop and livestock conservation	267	108	159
Other a/	948	494	454
Sewer Systems and Other Utilities	9,544	3,233	6,311
Water purification and supply	3,012	970	2,042
Sewer systems	5,961	2,030	3,931
Electric utilities	209	73	136
Other a/	362	160	202
Airports, and Other Transportation	856	521	335
Airports and airways	162	73	89
Navigation	669	435	234
Other a/	25	13	12
White Collar	17,003	10,622	6,381
Goods Projects	6,576	4,526	2,050
Sewing	4,946	3,819	1,127
Canning	193	129	64
Other a/	1,437	578	859
Sanitation and Health	2,824	1,933	891
Elimination of stream pollution	100	64	36
Mosquito eradication	764	363	401
Other a/	1,960	1,506	454
Miscellaneous	6,195	3,371	2,824

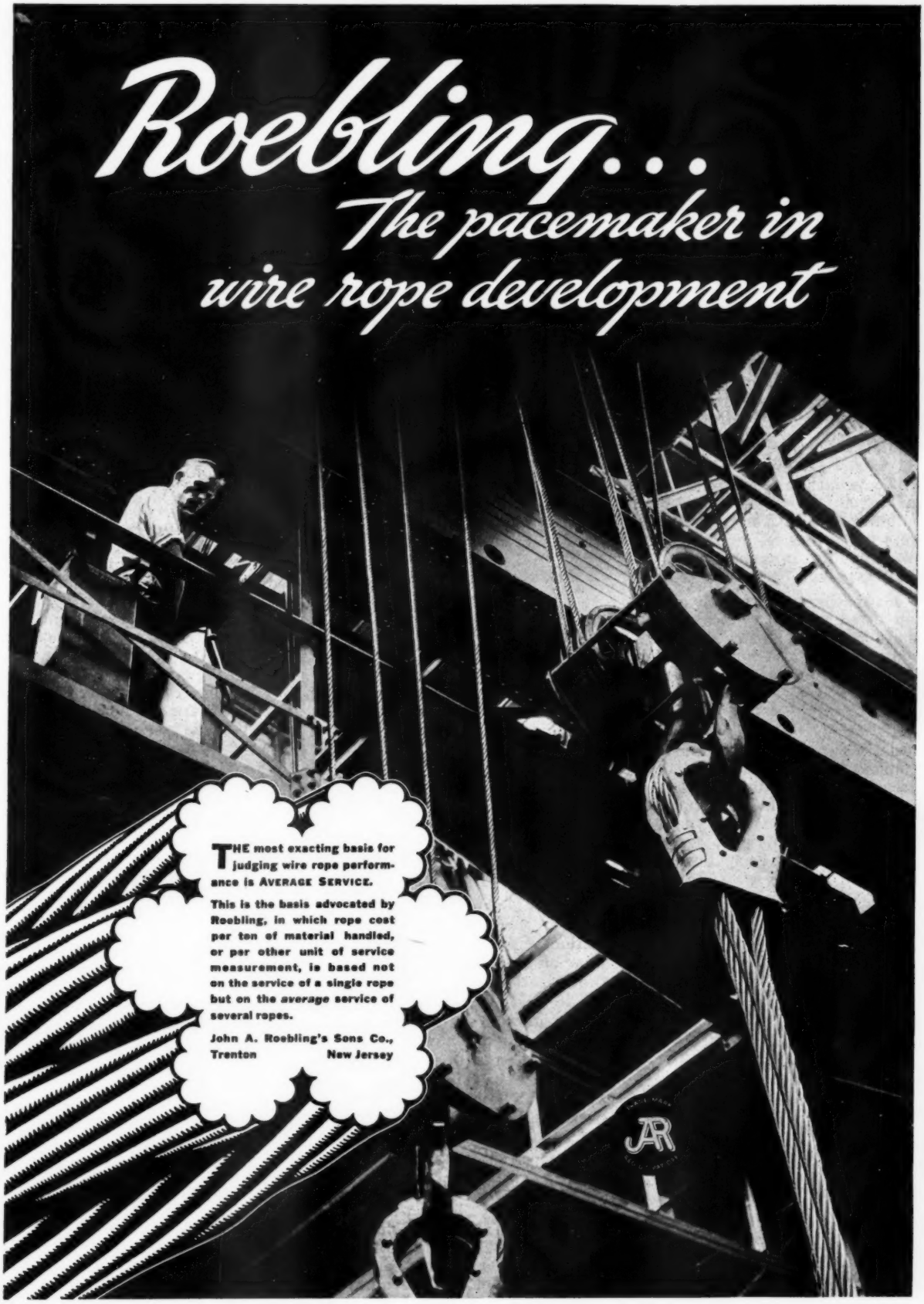
a/ Includes projects classifiable under more than one of the headings above.

State gas tax receipts are estimated at $1,425,000; vehicle license fees and other income, $773,500.

99 miles of grading, costing $1,215,000 will be done. Also scheduled are 215 miles of oil treatment surfacing, to cost $1,408,000—including base gravel—and 23 miles of gravel or crushed stone surfacing, to cost $165,000. Some state projects, and bridge construction, have not yet been determined.

There was no diversion of highway funds in Wyoming in 1936.

• *S. J. Groves' Allis-Chalmers model "L" is pulling a Le Tourneau Caryall scraper in building a road in Yellowstone Park, Wyoming.*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THE most exacting basis for judging wire rope performance is AVERAGE SERVICE.
This is the basis advocated by Roebling, in which rope cost per ton of material handled, or per other unit of service measurement, is based not on the service of a single rope but on the *average* service of several ropes.
John A. Roebling's Sons Co.,
Trenton New Jersey
JAR

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Equipment You Ought to Know About

(*Continued from page 38*)

carrying capacity. The load cushions can be removed and replaced in a few minutes without tearing down the coupling. Three types of resilient cushioning material are available for each of these couplings.

For further information, details and literature on the new coupling, address the manufacturer.

Worthington Vertical Turbine Pump

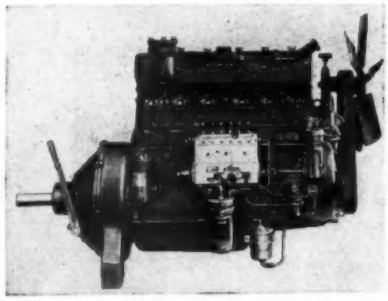
THE Worthington Pump & Machinery Corp., of Harrison, N. J., recently announced a vertical turbine pump designed and built especially for dewatering cofferdams, mines, quarries, etc., and ranging in capacity up to 10,000 gallons per minute.

A weatherproof motor at the top fitted with a vertical hollow shaft is grease lubricated to prevent leakage in transit or when the pump is not in a vertical position. The stuffing box is near the motor, and the stainless steel shaft serves the dual purpose of resisting corrosion and assuring ample strength. The inlet valve is grease packed thus requiring no attention from the operators. Intermediate bushings are made of hard bronze or any required special material depending upon the nature of the water, and are readily renewable. The Impellers, likewise, are of bronze and are carefully balanced. Locks prevent the impeller from working loose, yet permit easy removal if desired. The bowls containing the discharge vanes and the low head and discharge connections are of rigid cast iron construction. At the bottom is a galvanized basket strainer which protects the pump from foreign material likely to clog it.

These pumps are rated for total dynamic heads of from 20 to 60 feet and the motor sizes vary 870 to 1750 revolutions per minute. Bulletin W-450-B25 may be obtained upon request.

Buda Engines for Small Shovels

IN view of the increased interest in ⅜, ½, and ⅝ yard



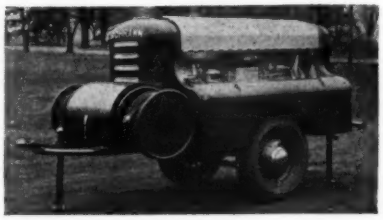
shovels, cranes, and draglines, the Buda Company of Harvey, Illinois has perfected several smaller sized Diesel engines to meet the demand. Illustrated is model 6-LD-468.

This is a six cylinder engine with a 4½ inch bore and a 5½ inch stroke. The outstanding features of this model are low injection pressure—therefore less wear on all reciprocating parts of the injection system, easy starting in cold weather through the use of glow plugs of low voltage capacity, low compression ratio of 12½ to 1 making it comparable to modern gasoline engines, and soft combustion, the maximum pressure being not over 625 lbs. per square inch.

Schramm Compressors

A "UTILITY" Air Compressor and a "Ford Air" Compressor have quite recently been placed on the market by Schramm Incorporated, West Chester, Pennsylvania.

The "Utility" Air Compressor is of vertical, straight-line construction with cylinders cast en-bloc. Between the compressor and engine units a clutch coupling is provided that allows the compressor to be disengaged when starting the engine. Gasoline powered sizes are offered with air deliveries of 85, 105, 160, 210, and 315 cu. ft. per minute. Diesel



powered sizes include the 105, 160, 210, 315, and 420 cu. ft. ratings.

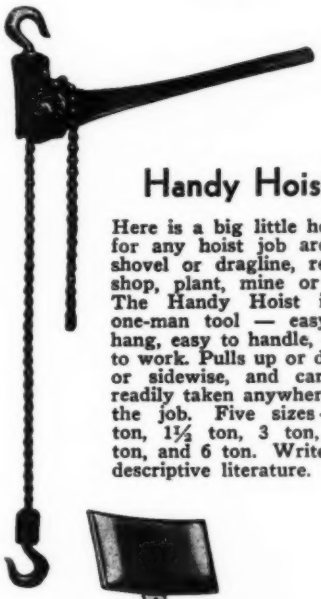
The "Ford Air" Compressor gives 105 cfm. of actual delivery at 100 pounds pressure. The driving unit is a Ford V-8 engine and the compressor is a duplicate engine converted over by the company. The compressor end delivers to an air receiver located over the compressor under the hood of the assembly. On the two wheel trailer arrangement, illustrated, are two hose reels connected to delivery from the air receiver, opened and closed by valves at the center of each reel. There is a capacity on each reel for 100 ft. of air hose.

Tunnel Type Excavator

A NEW type excavator has been developed by George Haiss Manufacturing Company, New York, for low headroom conditions, as in tunnel driving, cutting underpass excavations through railroad enbankments, under-trestle digging and the like.

Referring to the accompanying illustration, the machine is of 8 ft. overall height by 8 ft. extreme width. The digging action centers in the revolving picks and paddles carried on the extended tail shaft. Powered by the driving force of a large motor, this digging-feeding device will handle muck, clay, gravel and soft shale and pass 1½ to 1¾ cubic yards of material a minute to the bucket elevator. This in turn dis-

MONEY SAVING *Accessories*



Handy Hoist

Here is a big little helper for any hoist job around shovel or dragline, repair shop, plant, mine or pit. The Handy Hoist is a one-man tool — easy to hang, easy to handle, easy to work. Pulls up or down or sidewise, and can be readily taken anywhere on the job. Five sizes — ¾ ton, 1½ ton, 3 ton, 4½ ton, and 6 ton. Write for descriptive literature.

Push-Pull Jack

No matter how unusual your "push, pull, clamp, or straightening" problem may be, BECO Jack is the tool that gives you a safe, sure, and proved means of doing the job better. The drop-forged nuts, lever socket, ratchet and screw are heat-treated so that a welding heat will not damage the jack. Screw lengths — 10", 12", 14", 16", and 18". Capacity 35,000 lbs. Send for bulletin.

Wire Rope

Selected by the men who build your excavating and drilling machinery, Bucyrus-Erie rope has the special features that spell better performance. B-E wire rope has a uniform high quality, and comes in the right sizes, types, and construction for your exact needs. Send for wire rope bulletin.

Comfortable Seats

Avoid operator-fatigue and increase output — modernize your machines with BECO Seats. These seats are comfortable, provide insulation from vibration, are adjustable to the individual, and may be shifted from one machine to another. Descriptive bulletin sent upon request.

Blocks and Linings

BECO Blocks and BECO Linings take hold with a smooth, firm, accurate grip that means greater output for the machine and more confidence for the operator. Built for the gruelling demands of modern excavating. Write for details.

Power Cable

Bucyrus-Erie Power Cable is —compact . . . flexible . . . long-lived . . . vulcanized to produce a non-porous rubber jacket, absolutely waterproof and highly resistant to oils and acids. Write for prices.

Rope Sockets

Bulldog wedge rope sockets never fail. The harder the pull . . . the tighter the grip! Attachment is easy and quick and directly in line with pull, eliminating costly kinks. Made in a dozen sizes and four different styles. Write for bulletin.

Links and Rings

BECO Links and Rings save you time and money. The Links permit quick repairs to broken chain; the Rings revolve, spreading wear evenly. Order today.

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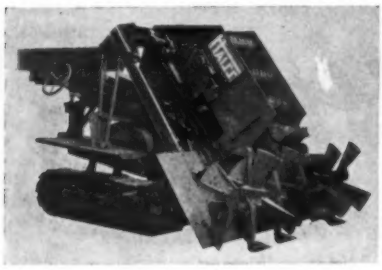
charges onto a short belt conveyor with a 5 ft. reach beyond the chassis frame. The design of the machine provides for knock down handling in passing the machine down a shaft for tunnel digging.



The Tunnel Excavator will excavate a bench cut up to 48 in. deep and will handle boulders up to six inches in diameter.

Hand-Cranked Diesel Engine

INTERNATIONAL Harvester Company has announced a new 6-cylinder Diesel power unit, model PD-80. This model has full Diesel economies plus the exclusive International starting method which converts the unit into a conventional gasoline engine which can readily be started by cranking.

Essential parts of the engine—cylinders, pistons, crankshaft, manifolding, cooling and lubricating systems—are common to both starting and Diesel operation. A quarter turn of a small crank, following a minute or two of gasoline operation, reduces the compression chamber to requisite size, shuts off the gasoline, and starts injection of Diesel fuel. This method of starting insures sufficient warming up in even the coldest weather.

Construction features, according to the manufacturer, are such as to give balanced, vibrationless performance. Cylinders are of special alloy material, heat treated, and replaceable. The 7-bearing crankshaft is chrome-molybdenum steel, drop-forged and electrically heat-treated. Main and connecting-rod bearings are steel-backed and copper-lead lined. They are precision type and replaceable. Pistons are aluminum alloy with a Silcrome insert at the top which acts as a heat insulator and increases the efficiency of piston ring operation.

Further details concerning this power unit may be obtained from the manufacturer. Please mention Excavating when writing.

6-Cylinder Heavy Duty Engines

THE Hercules Motors Corporation of Canton, Ohio, has added the following models to their line of QX four and six cylinder engines:

Model	Bore	Stroke	Displacement	HP
QXA	3⅛	4⅛	190	55.5
QXB	3¼	4⅛	205	60.

These engines are of the full force-feed type lubrication to all main and connecting rod bearings, are L-head, have an overall length of $35\frac{1}{16}$" height of $20\frac{9}{16}$"

and width of 16¾" generally. For industrial purposes completely endorsed power units are available. They are for application where small six cylinder engines are required in commercial vehicles, agricultural equipment, general industrial and road building machinery, oil field apparatus and marine purposes.

Lincoln Dual Arc Control Welder

ON October 1st the Lincoln Electric Company of Cleveland, Ohio, came out with a new line of single operator arc welders to be known as the "Shield Arc S.A.E."

The predominating feature of this welder, the manufacturer claims, is a new method of arc control which makes possible the adjustments of both arc heat and arc penetration in a continuous sequence of fine increments. This assures absolute uniformity of performance at every control setting.

The new welder permits the use of arc welding at a low voltage with wide current control range or the same wide range at a higher voltage.

The Shield Arc S.A.E.'s are available in the following motor types and ratings:

A-C Motor driven—200, 300, 400, and 600 amperes.

D-C Motor driven—300, 400, and 600 amperes.

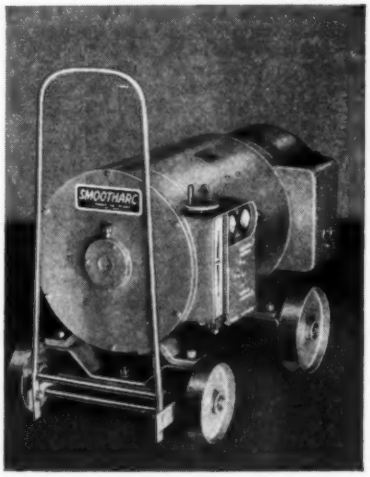
Generator for belt or couple service—200, 300, 400 and 600 amperes.

Engine driven—200, 300, 400 amperes.

"Smootharc" Welder

ANOTHER machine for the welding field has been designed by The Harnischfeger Corporation of Milwaukee. It is the "Smootharc" Welder featuring single current control, self-excitation, and internal stabilization. The new welders are built in both vertical and horizontal types for stationary and portable mounting; the vertical units being available in three sizes, 75, 100, and 150 amperes, and the horizontal in 200, 300, 400, and 600 amperes.

All instruments are concentrated in a single control panel built into the side of the generator frame. The A. C. motor starting box is built into the side



of the motor housing, and the streamlined appearance is achieved through the use of all rolled steel and arc welded construction.

There is no substitute for Gatke Quality

ASBESTOS BRAKE AND FRICTION BLOCKS

WOVEN BRAKE LINING

HYDRAULIC COMPRESSED BRAKE LINING

ASBESTOS PACKINGS

MOULDED NON-METALLIC GEARS AND BEARINGS

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GENERAL OFFICES
228 N. LA SALLE ST. ● CHICAGO, ILL.

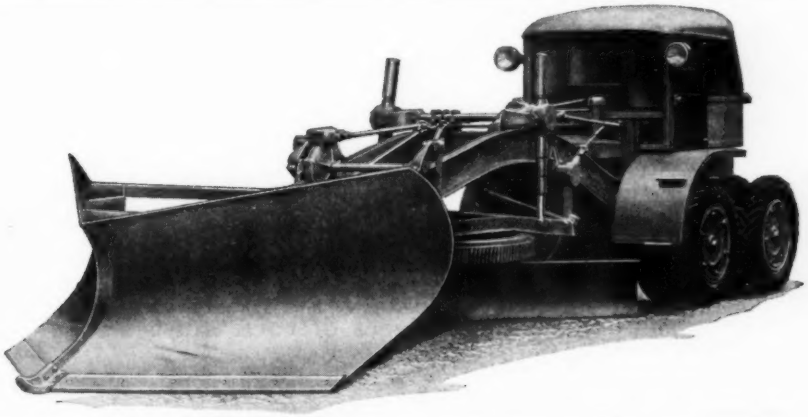
Any Width to 14 Ft.--
Laid Smooth as Velvet--
Faster than Your Plant Can Mix

With its 18 ft. straight-edge runners to equalize the surface, its semi-crawler traction all on hard subgrade, its pug-mill spreader, its ability to blend smooth joints and adjustability up to 14 ft. widths—the Jaeger Paver lays precision smooth pavements, faster and at lowest known cost. Send for Catalog and Prices.

THE JAEGER MACHINE CO. 553 Dublin Avenue Columbus, Ohio
World's Largest Builder of Spreading and Finishing Machines

JAEGER *Bituminous* PAVER

Out in front again!



WARCO again comes to the front, now with a heavy duty V type snow plow for use in connection with their new rear control graders.

Tough winter going is made easy with J & S Traction Treads. They bridge the space between the tires and make the wheels grip the ice, snow, mud or slippery surface. Traction Treads are heavy duty equipment, manufactured for any truck, grader, etc., using either single or dual pneumatic tires.

Their line of rear and center control Motor Graders, including three new models, are so sturdily constructed, amply powered, and correctly designed that they virtually force their way out in front.

W. A. Riddell Corporation

Successor to W. A. Riddell Co. - Hadfield-Penfield Steel Co. - American Clay Mchy. Co.
BUCYRUS, OHIO
Interested Distributors write Dept. B

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Model "S-O" Controlled Ignition Tractor

THE Allis-Chalmers Mfg. Company of Milwaukee, Wisconsin has developed a new Diesel fuel model tractor to be known as the "S-O" Controlled Ignition Tractor. The controlled ignition principle, is claimed by the manufacturers, to eliminate excessive weight and destructive vibration, and to insure complete combustion of diesel fuel.

Other features include a six speed transmission with truck type gear shift, permitting changing of gears without stopping the tractor, truck frames completely equipped with anti-friction and roller bearings, wide track shoes to reduce ground pressure and increase stability and traction, and high degree of balance by careful proportioning of weight, power, and speed.

The "S-O" weighs 18,000 pounds and is for use with bulldozers and bullgraders, 8-yard scrapers, 10 and 12 foot graders, and 8 to 12 yard wagons.

Low-Range Direct-Current Arc Welder

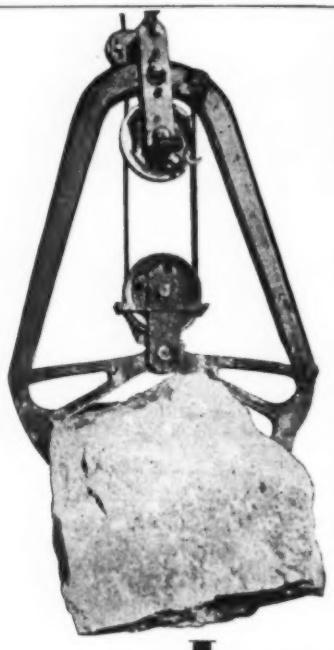
A NEW departure in arc welding, a low-range, direct-current welder, utilizing rectifier bulbs instead of rotating equipment, is being introduced by the General Electric Company. Designed to operate on three-phase, 50- or 60-cycle power, 230, 440, or 550 volts, this machine uses four mercury-Tungar bulbs. It has ample capacity for welding all light-gauge car or truck parts in construction and maintenance work, and can be used to fabricate metal roofs and ceilings, steel cabinets, blower and ventilating systems, and steam fittings. It is light-weight, easily portable, and has a current range of from 25 to 75 amperes, controlled by a nine-point tap switch.

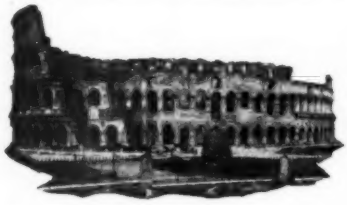
The equipment is mounted on hard-rubber casters for easy moving and weighs 140 pounds, net. Overall dimensions are 27 inches by 24 inches by 14 inches.

Novo Diesel-Powered Road Pump

THE Novo Engine Company, Lansing, Michigan, is now offering a diesel powered road pump to supply water for pavers, cutting, jetting, and sprinkling.

The power unit is a heavy duty, 6-cylinder industrial engine, built for 24-hour-a-day service and to give greater flexibility and smoother flow of power. It develops from 40 to 55 horsepower.





12,000 Barbarians placed the Colosseum's stone

It took 12,000 slaves 10 years to build the greatest monument in Roman architecture. Begun by Emperor Vespasian in 72 A. D., the Colosseum accommodated 73,000 eager spectators for the barbarically splendid battles of the gladiators. Water piped beneath the large arena made it possible to form or drain an artificial lake at a moment's notice. The 80 ponderous arcades, the massive stone tiers, were built nearly 1900 years ago; but some of the same crude, rope-roller-lever methods which built them are still being used today.

IN HANDLING their quarry stone with slings the Roman engineers had no choice—but ancient methods are not necessary on today's job. There is a new and far better method utilizing the Bucyrus-Erie Rock Grab. Whenever large pieces of rock must be lifted, this unit will save time and expense. Easy, simple, safe in operation . . . it picks up, carries, and places rock weighing to 20 tons—and does it as easily and surely as you would pick up a match box between your fingers.

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EXCAVATING, DRILLING AND MATERIAL-HANDLING EQUIPMENT

SOUTH MILWAUKEE, WISCONSIN

BUCYRUS ERIE

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Speeding up Operations at Ballona Creek

California flood control project goes ahead of schedule with modern equipment.

By John R. Marcy

BALLONA CREEK runs through the outskirts of Los Angeles from Culver City to the sea, a distance of about eight miles, and is one of those California creeks that have to be irrigated. In the rainy season, however, it is sometimes called upon to handle a great deal of water, and for that reason it a part of Los Angeles County's huge flood control project, all of which is under the direction of U. S. Army engineers. At Upper Ballona Supt. Wm. J. Leen is in charge.

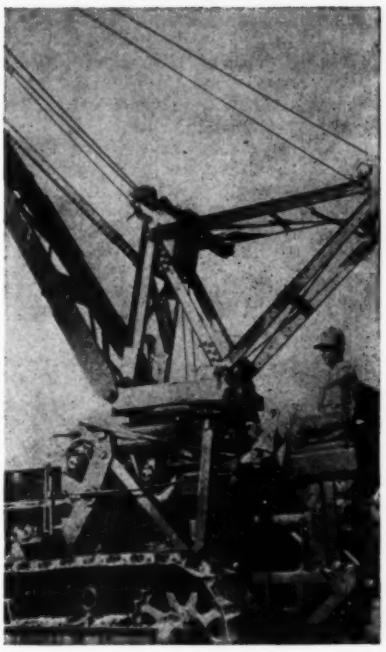
Ballona Creek is divided into two projects, and work on the upper half is well along. Work here was begun in 1935 entirely with hand labor. While this gave employment to a great number of men, which was the intention, progress was slow. Plans called for the excavation of a waterway, not always following the bed of the creek, varying in width from 60 to 80 feet, with 2½ foot thick concrete slab, and 17 foot high steel reinforced concrete side walls, 2½ feet thick at the base and graduating to a foot at the top.

This in itself was quite an order, but when it is considered that the job lay in a populous district, with bridges across streets to be built, sewers replaced (one, the Genessee sewer, had to be lowered eight feet by hand in the rain) and extra drains installed, it is not surprising that in April of last year the work was three months behind schedule.

Then equipment was hired and purchased and the picture changed. At present Upper Ballona is four months ahead of schedule, with the greater part of the slab and side walls poured. Before the beginning of the last rainy season, which usually starts in November, the construction of the large bridge across Adams Street, a main thorofare, near the end of the section, was completed.

Because of the large number of jobs included in the Flood Control Project, equipment is transferred irregularly from one job to another. At the present time three Osgood cranes and one P&H shovel are handling the excavation, each operating six days a week in three shifts. These shifts are irregular in hours and days, because of the fact that the men on W.P.A. work here are limited to 120 hours a month. About 15 trucks, Dodge, Internationals, Fords, mostly rented, are moving dirt and materials at the job.

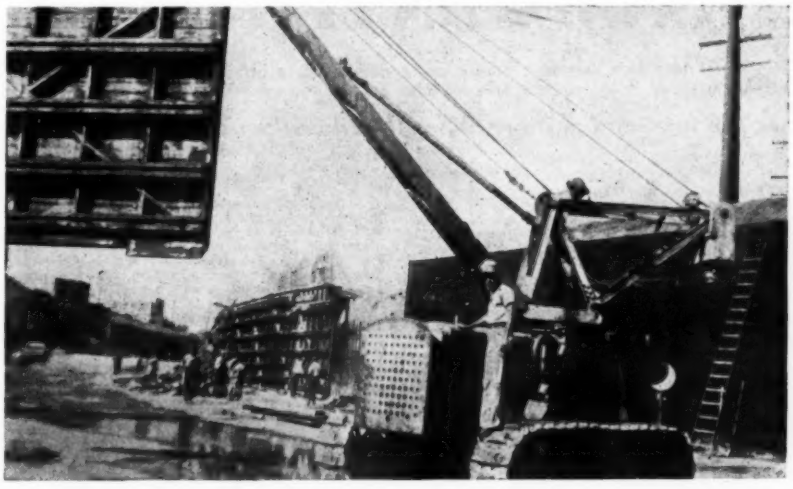
Special interest is being taken here in the new Model 60 Bucyrus-Erie Loadmaster purchased by the County last spring. This is something new here, and is considered especially adapted to the type of work involved in this project, where much shifting of materials in cramped quarters is necessary. It moves swiftly, the boom can be operated while travelling, and the whole machine is so sturdy that no repairs have as yet been necessary. According to all reports it has more than fulfilled expectations. Operator John T. Wilmont says that it uses only five to ten gallons of fuel oil a day, often so little that it is not considered worthy of a separate expense item and is just charged up to one of the shovels.



• *Operator Wilmont pauses a moment and sizes up progress on the army engineers Ballona Creek flood control project.*

Three Caterpillar diesel bulldozers, two 20's and one 75, are employed on the cut, with one sometimes utilized in the project yard on the bank of the creek at the upper end, piling sand and crushed rock. Some 15 more trucks of assorted types are hauling sand and rock to the job. Crushed rock is partly brought in from the County's own quarry at Santa Monica, and part contracted from local dealers. At present, sand is supplied by one of the latter, and piled at the yard. Here two Barber-Greene aggregate loaders transfer it to trucks which dump it in a Butler batcher, also in the yard, from whence it is hauled to the two Ransome mixers at the scene of construction.

As much hand labor as possible is still being utilized, and somewhere in the neighborhood of 1000 men are employed on Upper Ballona. Because of the limited man-hour allowance, however, this does not mean as much as it ordinarily would, and great credit for the present rate of progress is certainly due to the efficient management of those in charge, and to the cooperation of the men under them.



• *Handling wood forms is one of the jobs handled on the upper half of the Ballona Creek project by the new Bucyrus-Erie Model 60 Loadmaster.*

Book Reviews

"Maintenance of High Speed Diesel Engines" is the title of a well illustrated and detailed handbook for Diesel engine fleet owners, maintenance engineers, operators, drivers and mechanics, newly published by D. Van Nostrand Company, Inc., 250 4th Avenue, New York City. It is written by Arthur W. Judge and includes information on fuel injection systems, valves and valve seatings, cylinders, connecting rods, starting procedure and running troubles, fuel pump timing, the governor, general maintenance, working principles, etc. The book is cloth bound, has 192 pages and more than 150 diagrams, cross section drawings, and photographs.

D. Van Nostrand Company, Inc. will furnish this volume for $3.50.

A 24-page booklet on its line of batteries has just been published by the **B. F. Goodrich Company**, Akron, Ohio. Four pages are devoted to the description of the new Kathanode construction used in two batteries for light trucks, and seven heavy duty truck and bus batteries, with all specifications. This construction, using flexible, porous spun glass mats, holds the active material in the positive plates for a great length of time, increasing starting power, so it is claimed.

The remainder of the pages are devoted to a discussion of battery power requirements for trucks and buses, and to replacement data on batteries for buses, trucks, fire apparatus, hearses, and tractors. This booklet can be obtained by fleet owners, superintendents, or independent owners upon request to the company.

A portfolio of New Deal Reconstruction comes to our attention this month. This pamphlet describes and illustrates reconstruction and rebuilding started as a result of the neglect caused by the depression.

The T. V. A. project, Grand Coulee Dam, Bonneville Dam, Fort Peck Dam, Missouri, Mississippi River project, New York Triborough Bridge, Manhattan, New Jersey, Queens Midtown tunnel and the All American Canal in California are described and pictured in this interesting and enlightening portfolio.

The Blaw-Knox Company of Pittsburgh, Pa., has issued two new bulletins describing and fully illustrating their Bottomless Scrapers and Sheepsfoot Tamping Rollers.

No. 1550 gives information concerning the tamping rollers, describing flexibility and utility, specifications, construction and cleaning teeth, and illustrates the equipment on various jobs.

No. 1540 is concerned with the scraper and describes features of one man control, hydraulic action, phases of operation and construction, and specifications. Both of these bulletins may be obtained upon request to the manufacturer.

A 48 page booklet, issued by **The International Nickel Company, Inc.**, 67 Wall St., New York City, tells of the uses and qualities of Monel Metal. Numerous excellent photographs depict such uses as in hydraulic plants, steam lines and turbines, transmission lines, pumps and pipe lines, highways, sewage disposal, refrigeration and freezing, ships, and railways.

Trade Notes

The W. A. Riddell Company of Bucyrus, Ohio, under receivership for the past three years, is now completely reorganized and is to be known as **The W. A. Riddell Corporation.**

All productive assets including land, buildings, equipment, patents, contracts, license agreements, etc. have been retained with no pending litigations of any nature.

Mr. H. F. Holbrook will head the Corporation as Vice President and General Manager and will be aided by the same major executives of the former organization.

The Easton Car and Construction Company of Easton, Pa., has appointed **the H. B. Fuller Equipment Company** as agents in the Cleveland territory. The Fuller Company will handle the complete Easton line including quarry equipment, dump bodies and industrial cars, lift trucks, electric bitumen heaters, railway and industrial turntables, industrial trailers, etc.

National Carbon Company, Incorporated, a unit of **Union Carbide and Carbon Corporation**, on November 2nd, turned over the sale of Gredag Lubricants to a new firm known as the **Gredag Corporation**, Buffalo Avenue, Niagara Falls, N. Y.

The Gredag Corporation is a new and independent company, and is in no way identified with the Union Carbide and Carbon Company.

November 10th the **Kingston Trap Rock Company, Kingston Bituminous Products Company, L. R. G. Contracting Company**, and **Linus R. Gilbert, Incorporated**, removed their executive offices from 7 Watchung Avenue, Plainfield, N. J., to their new office building at Kingston, N. J. (Just off the old Lincoln Highway).

The Chain Belt Company of Milwaukee announces the new location of the Portland, Oregon office, which has been moved from 215 S. W. 1st Avenue to 112-118 S. W. 1st Avenue, in order to carry larger stocks and better serve the territory.

Help Wanted

SUPERINTENDENT STRIP MINE. Coal operator wants superintendent thoroughly experienced on all makes of draglines, shovels—Diesel, gas, and electric. Must have ability to handle men. Outline fully in first letter all qualifications, age, experience, references, and salary expected. Box 8602 c/o Excavating Engineer.

POSITIONS WANTED

Positions wanted advertisements will be run under this heading for 5 cents per word, minimum charge $1.00. Advertisements for help wanted free of charge.

Address all box numbers c/o Excavating Engineer at South Milwaukee, Wisconsin

EXPERIENCED OPERATOR

Operator with 13 years' experience on shovels, 3 on clamshells, and 2 on cranes desires position in South. Has operated steam and gas rigs in road construction, bridge work and basement excavation. Prefers work on Bucyrus-Erie or Lorain gas machine. Single, 31 years old. Can furnish very best references. Located Massachusetts. Box 8501.

DRAGLINE OPERATOR

Operator having 10 years' experience on Diesel dragline, on levee and canal construction desires position on Diesel machine of 3 to 8-yard capacity, preferably Bucyrus-Monighan dragline. Willing to go anywhere. Can do own repair work. A-1 references. Age 30; married. At present located in Nebraska. Box 8301.

OPERATOR

18 years dragline experience — 5 years on steam, 8 years on electric and 5 years on Diesel machines. Can do own repair work, prefer steam or electric Bucyrus machine, large or small. 51 years old, married. Can furnish excellent references. Now located Tennessee. Box 8402

EXPERIENCED OPERATOR

Operator having 17 years' experience on all types of excavating machines desires position on drag shovel, dragline, Bucyrus-Erie or Northwest, gas or Diesel. Can handle any machine from one to 8 yards. Experience includes four years on steam machines, two years on electric, 8 years on gasoline, one year on Diesel and two years on Gas plus Air. Have two years experience on drag shovel on pipe line work. Willing to go anywhere in the U. S. A. Age 36; married. Can do own repair work and have best of references. Present location, Florida. Box 8401.

OPERATOR

Experienced operator desires position; will take work anywhere. Has 17 years experience; two on shovel work, nine on draglines, two on clamshells, four on cranes. Has operated steam rigs five years, electric two years, gasoline five years, Diesel five years. Prefers work on Bucyrus-Monighan or 41-B, steam or Diesel rig, one to six-yard size. Can do own repair work; 34 years old, married, can furnish good references. Now located in Ohio. Box 8601.

SHOVEL-DRAGLINE OPERATOR

8 years' experience on shovel work, 2 years' on steam dragline, all in quarry excavators. Willing to go anywhere. Prefer working on standard Marion or Bucyrus-Erie machines. 35 years old, married. Can do own repairs. Special references. Now located southern Indiana. Box 8502.